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ABSTRACT

THIS EVALUATION REPORT OF IPI IN ITS SECOND YEAR CONCENTRATES ON THREE MAIN POINTS: STUDENT ATTITUDES TOWARDS IPI, TEACHER AND STUDENT CLASSROOM ACTIVITY AND INTERACTION, AND STUDENT ACHIEVEMENT DURING THE SCHOOL YEAR. AN ACCOUNT OF OVERALL IMPRESSIONS CONCLUDES THE REPORT WHICH DOES NOT ATTEMPT TO FORMALIZE ANY CONCLUSIONS. IT STRESSES, HOWEVER, THE POINT THAT IPI IS STILL IN ITS INFANCY AND HAS A LONG WAY TO GO BEFORE IT MATCHES THE MODEL OF INDIVIDUALIZATION OF INSTRUCTION ENVISIONED BY ITS DEVELOPERS. SO FAR IT DOES NOT BEGIN TO DO SO; FOR THE SECOND YEAR, MEASURED ACHIEVEMENT IN IPI IS LESS THAN THAT OBSERVED IN NON-IPI CLASSES. IF THIS TURNS OUT TO BE THE FINDING IN OTHER AREAS WHERE IPI IS BEING TRIED OUT, FURTHER DEVELOPMENT MIGHT BE NEEDED BEFORE THE PROGRAM COULD MERIT NATIONWIDE DISSEMINATION. (GO)

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A SECOND YEAR EVALUATION OF INDIVIDUALIZED PRESCRIBED INSTRUCTION (IPI)

by

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Preface

This second year evaluation report contains three main sections: I. Student Attitudes Toward IPI; II. Teacher and Student Classroom Activity and Interaction; III. Student Achievement Over the School Year.

Each section includes a discussion and conclusion section but a final overview concludes the report. Most of the tables and tabulations have been assigned to an Appendix. All the questionnaire and achievement data described are on IBM cards and participating schools are invited to use these cards if they wish to conduct further analyses.

The collection and analyses of the data was performed under contract by The George Washington University for Project EDINN. We wish to thank the students, teachers, and administrators of the participatory schools for their cooperation and patience. A special thanks is due Mrs. Heloise Dales of Project EDINN for her role as coordinator and consultant and to Miss Annette Mahikoa who assisted in the compilation and collection of data and in the preparation of this report. The compilation and writing of this report was made possible through a grant from the University of Pittsburgh. Our sincere thanks to Dr. John Bolvin of the Learning Research and Development Center of the University, not only for seeing that funds were made available for this report, but for his intellectual integrity and for his desire to have IPI looked at honestly and critically.

The authors assume full responsibility for the opinions and interpretations presented here. We have tried to separate interpretation from results so that each reader can draw his own preferred conclusions from the <u>given data</u>.

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Introduction:

Eight schools were involved in the IPI program. Four schools used IPI math or reading, and four schools, paired with each IPI school, used a conventional program. A brief description of each of these schools is essential for interpreting what differences and similarities we will present later on.

School A A new school in which all 4th, 5th, and 6th grades are housed in one large, self-contained building. Classes, however, tend to be self-contained within the larger complex -- each teaching area becoming bounded by shelves, bookcases, etc. Last year IPI reading was introduced. This year, in addition to continuing with IPI reading, the school adopted IPI math as well. Math and reading are given by individual teachers to grade level groups.

The students at School A come from middle to upper-middle class families. Minority group representation is limited to a very small number of oriental children. The comparison school for School A is

School B: A traditionally-built school with self-contained classrooms. The reading program is largely a function of the individual teacher. The socio-economic background is, if anything, slightly higher here than at School A. There are virtually no minority group students involved.

School C: This is an old (probably 30-40 years) building located in a semi-suburb rural area. The school district is relatively poor. The students are approximately 40-50% Mexican-American. IPI math, now in its second year, is held in the orchestra pit area of the school auditorium; grades 4, 5, and 6 are mixed and meet in large group sessions. Two teachers and two aides handle approximately 60-70 children at a session. In the first year of IPI each 4th, 5th, and 6th grade teacher gave IPI in a self-contained classroom. Socio-economically, a majority of the families would probably be described as lower-middle class -- farm laborers. The comparison school is

School D: Located in the same school district as School C, the student-body comes, nevertheless, from a slightly higher socio-economic group; there is a lower proportion of Mexican-American children in this school. The school itself is newer and more modern than School C. It is self-contained and children are grouped by grade level.

School E: Located in a residential community, this school caters to a white middle-class population. Grades 1, 2, and 3 -- those involved in the formal IPI evaluation -- are located in the self-contained classroom section. The school has adopted IPI math for its 4th, 5th, and 6th graders but this group meets in a new large-group facility. At School E, two days out of the week are given over to IPI "seminars" where each class works on a topic selected by the teacher in a traditional classroom setting; no IPI materials or grouping by IPI placement appears to determine the selection of students or topics for these twice-weekly seminars. Ability grouping occurs here, so that 2nd and 3rd graders are not identified as such, and we could not determine who were 2nd or 3rd graders in any given group. The comparison school is

School F: A somewhat newer, but basically same kind of school as School E. Classrooms are self-contained, each grade having a single teacher for the day. The socio-economic background is quite similar and, perhaps, just slightly higher than the School E population.

School G: This school is located in a mountain-resort area. Children are virtually all caucasian and middle-class. IPI math, in its second year, is presented in a large complex where all 4th, 5th, and 6th graders spend the day. There is a greater sense of non-containment serious informality in this center than seen at School A. All of the students receive math (IPI) from one of three teachers, but at different times and in separate groups. The control school is

School H: An older school but highly similar in student body and neighborhood background to School G. Classes are self-contained by grade level. Math is taught conventionally, except that the 6th grade chosen in the evaluation is taught by a teacher who, on her own, has been able to individualize her program using regular material. This exception becomes apparent in some of the findings and will be pointed out where appropriate.

In a field study of this sort it is not feasible, nor in some respects necessary, to control for all possible differences between the "treatment" school (IPI) and its counterpart. Rather, if we know enough about the conditions under which instruction was held in each setting, we can allow for those differences which we feel relate meaningfully to our criteria. A more substantial factor, however, is this: If the effects of a new program (in this instance IPI) are so slight, or are marked by certain differences, then it is questionable whether a school system should consider the change when, as is well known, change is always difficult to introduce and maintain. This, then, is our initial bias. We expect a new program to not simply be as good as the existing program; it must be clearly and demonstrably better. We hope this report will assist those in position of responsibility to make the judgement with greater confidence.

I. Student Attitudes Toward IPI

The 4th, 5th, and 6th graders in both the IPI and Comparison schools were administered a pencil and paper questionnaire a few weeks before the close of the school year. We did not attempt to query the 2nd and 3rd graders for the obvious reasons. In this section we will report the results of those items which reflect IPI-Comparison differences and which provide interesting information.

A word on the format for presenting questionnaire results. We will first present, in form of percent of students checking each response alternative, the total school results for each pair of schools. Then, if there are meaningful differences on the basis of grade level or ability level, we will present these. Following the presentation of the results, we will state the apparent findings and then comment upon them for each group of items.

On the assumption that IPI has motivational properties and is perceived as attractive by students, we first asked:

(4) Please put a check in the boxes ☐ by your two most favorite subjects. Be sure to read the whole list first.

☐ (a) Arithmetic
☐ (b) Spelling
☐ (c) Grammar
☐ (d) Reading
☐ (e) History
☐ (f) Language
☐ (g) Science
☐ (h) I don't like any of them.

If IPI is popular, arithmetic and/or reading should be perceived as more attractive in the IPI schools. The total school results appear in Table 1 below.

Table 1

Percent of Students in Each School Indicating Attractiveness of Subjects						
Subject	Schools A*	B	C*	D	G*	H
Arithmetic	65	34	66	56	73	34
Spelling	26	26	36	38	22	36
Grammar	04	02	02	02	01	00
Reading	37	63	26	35	32	52
History	33	11	20	18	19	18
Language	18	12	17	17	26	10
Science	36	41	25	31	15	35
Don't like any of them	01	05	04	01	02	00

*IPI School

Clearly the ranking of arithmetic is greatly enhanced by IPI. School A, it must be remembered, has both IPI math and reading. The reading difference, however, is clearly in favor of the non-IPI school, School B. This result is highly similar to the first year finding which showed that the IPI reading program is not nearly as salient to students as is math. But the attractiveness of IPI math seems unmistakable and reflects a maintenance of an appeal which appeared in the first year of IPI. The only cautionary note is that, when broken down by grade level, the attractiveness of IPI math decreases from the 4th to the 6th grade in both IPI schools. Balancing this, however, is the finding when broken down by ability level.* This appears in Table 2.

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*Ability level is determined by a child's ranking in his own class on the Lorge-Thorndike Intelligence Scale. We divided each class into thirds; those in the upper third we designated as high ability, those in the middle third as average ability, and those in the lower third as low ability.

Table 2

Percent of Students in Each School, in Each Ability Level, Choosing Arithmetic as Their Favorite Subject						
Ability Level	Reading		Arithmetic			
	School A	School B	School C	School D	School G	School H
Low	74	39	65	60	69	16
Average	58	32	74	51	80	37
High	65	31	53	50	72	45

It can be seen from Table 2 that, in general, the low ability students find IPI most attractive. This is most promising in that it is generally recognized that it is this group which is most in need of some motivational force to enable them to continue to work in math.

Another question on the topic of interest-motivation was:

(13) Please put a check in the box next to the sentence below that you agree with.

☐ I like IPI because it (arithmetic*)
- ☐ is easy and fun.
- ☐ keeps me interested.
- ☐ I can work by myself

OR

☐ I do not like IPI because it (arithmetic*)
- ☐ is hard and no fun.
- ☐ is not interesting.
- ☐ I have to work by myself.

*Used in place of the word "IPI" when given to comparison schools.

The results to Item 13 are shown in Table 3.

Table 3

Percent of Students in Each School Indicating How They Feel About IPI						
	School A	School B	School C	School D	School G	School H
Easy and fun	16	30	23	26	22	15
Interested	26	48	39	41	37	36
Work alone	49	06	24	10	25	14
Hard and no fun	01	06	01	07	01	09
Uninteresting	05	08	03	07	02	16
Must work alone	01	00	00	01	00	00

It can be seen that fewer IPI students in each pair chose a negative alternative. The reasons for liking IPI, however, differ among schools. Almost half (49%) of the School A students like it because "I can work by myself" whereas the other positive reasons are more equally represented in the other two IPI schools. There are no marked differences in the basic attitude nor the reasons for that attitude due to either grade level or ability level. Interestingly, the percentage of students in the non-IPI schools checking a negative reason is much lower than one would suspect from the figures in Table 1. Perhaps math is liked well enough but relative to other subjects is ranked lower. Again, the results reveal the attractiveness of IPI math to students at all grade and ability levels.

To explore this more specifically, we asked IPI students to write in one item, the thing or things they liked about IPI and, in another item, the things they didn't like. Overwhelmingly, the most attractive feature was self-pacing; "be able to work at your own speed" or "working by yourself" was mentioned by approximately three-fourths of all students at each of the IPI schools. It was difficult to get students to think of a negative comment to write in. When such comments did appear, they usually referred to dislike

of a specific content area (Geometry or Fractions, for example). Thus, it would be fair to conclude that students are highly attracted to IPI and it is its breaking of the group-paced lock-step that is IPI's predominant attraction.

The developers and proponents of IPI have hypothesized that the program should result in certain changes in student behavior and attitudes. We examined a few of these by asking the children the following series of questions.

(14) Please check the box by the sentence below which best describes how you feel.

☐ (a) It is important for me to get the best grades in the class.

☐ (b) I like to get good grades but I don't worry too much about doing better than the other students in my class.

☐ (c) I don't care how well I do compared to the other children in my class.

Presumably IPI should reduce some of the competitiveness found in class-paced learning since each child serves as his own standard. Accordingly, he should be less concerned with outscoring others in the class and the response to alternative (a) above should be lower in the IPI schools.

Table 4

Percent of Students Responding to Item 14						
	School A	School B	School C	School D	School G	School H
Important to get best grades	34	29	39	47	29	39
Neutral	58	65	42	44	55	42
Don't care	08	06	14	08	11	14

As shown in the table above, the overall school totals suggests a trend in this direction. There is, however, an interaction with ability level and this is shown in Table 5.

Table 5

Percent of Students, by Ability Level, Responding to Item 14						
	School A	School B	School C	School D	School G	School H
Important to get best grades	45 27 29	36 36 19	40 34 30	70 41 38	47 27 15	36 38 41
Neutral	47 58 65	54 51 81	37 47 53	25 51 50	40 55 75	40 53 55
Don't care	08 13 04	11 07 00	19 13 13	05 08 13	09 13 11	08 09 00
	LO AV HI	LO AV HI	LO AV HI	LO AV HI	LO AV HI	LO AV HI

In each of the three pairs, the low ability IPI students seem to have a stronger competitive need while the average and high ability IPI students have a weaker one. Maybe the earlier finding that IPI seems especially motivating for low ability students is resulting in their higher achievement orientation, but this is just conjecture and we cannot defend it at this time.

Along the same vein, does exposure to IPI result in a change in a child's perception of his own performance vis a vis his classmates? We asked this question.

(6) Please put a check in the box by the sentence below which best describes you. In arithmetic, I

☐ (a) do better than most of the students in my class.

☐ (b) do as well as most of the other students in my class.

☐ (c) do not do as well as most of the other students in my class.

☐ (d) do not know how I do compared to the other students in my class.

The results, appearing in Table 6, indicate little overall difference between IPI and non-IPI students. Strictly speaking, one could assume that IPI students should "not know how I do compared to other students" but, as will be shown, it is unrealistic to think that students would cease to be somewhat aware of their relative class standing.

Table 6

Percent of Students Responding to Item 6						
	School A	School B	School C	School D	School G	School H
Better than most	09	14	09	09	18	13
As well as most	57	64	50	50	51	50
Not as well as most	08	06	10	21	13	22
Don't know	25	17	26	20	13	11

Clearly, however, IPI students fully realize that the program is not teacher-determined. We asked,

(11) Please put a check in the box next to the sentence below that tells what is happening when you do IPI. (Arithmetic or Reading for Comparison schools)

☐ (a) Almost everybody in the class is learning the same thing.

☐ (b) Almost everybody in the class is learning something different.

☐ (c) I don't know what other students in the class are learning.

The results, as shown in Table 7, are unequivocal. Little comment need be added to these figures.

Table 7

Percent of Students Responding to Item 7						
	School A	School B	School C	School D	School G	School H
Learning the same	05	50	04	70	11	49
Learning different things	73	29	67	16	75	34
Don't know	22	20	24	15	08	11

Earlier we pointed out that the self-paced aspect of IPI appeared to be its most attractive and motivating feature. We asked students,

(10) Put a check in the box next to the sentence below which best describes you in arithmetic.

☐ (a) I'm learning about as much as I can right now.

☐ (b) I could learn more if we went faster.

☐ (c) I could learn more if we went slower.

Overall, 75% of all IPI students believe they are "learning about as much as I can right now." The total school results appear in Table 8.

Table 8

Percent of Students Responding to Item 10						
	School A	School B	School C	School D	School G	School H
Much as I can	75	52	79	59	75	67
More if faster	16	35	10	20	16	10
More if slower	09	12	07	20	03	18

It is interesting to note that the only non-IPI school to approach this level is School H (67%) where, as mentioned earlier, the 6th grade was essentially individualized through the efforts of the classroom teacher.

The ability level differences for this item are interesting. These are shown in Table 9. Generally, except for Comparison School B, the higher ability students in both types of programs seem somewhat more satisfied with their perceived rate of learning. The tendency for low and average ability students to choose the alternative responses of "I could learn more if we went slower (faster)" is a perplexing finding as the IPI student should feel that he is working at a rate which is best suited for himself. Perhaps this data can be explained by a need on the part of the less successful student to find an explanation or rationalization for his relatively poorer performance (we are assuming that low and average ability students do perform relatively poorer as compared to the higher ability students in their classes). It is

difficult to interpret what an IPI student might mean by wanting to go faster or slower (although some specific clues are offered in the interviews described later). Two possible explanations for wanting to go faster are plausible: (1) every time a student fails a CET or post-test, he has to redo the same type of worksheets; (2) there is time wasted waiting for worksheet assignments, scoring, etc. Why some IPI students wish to go slower is beyond us. It is clearly understandable in a conventional class and appears significantly more often as a response in the comparison schools as shown in Table 9 below.

Table 9

Percent of Students, By Ability Level, Responding to Item 10

	School A			School B			School C			School D			School G			School H		
Much as I can	65	81	86	61	50	46	77	87	75	50	62	67	69	77	92	48	75	77
More if faster	22	13	08	25	39	46	12	02	15	30	14	21	22	18	04	08	06	18
More if slower	12	06	06	10	11	08	07	06	05	20	22	13	07	02	04	32	19	00
	LO	AV	HI	LO	AV	HI	LO	AV	HI	LO	AV	HI	LO	AV	HI	LO	AV	HI

One of IPI's main selling points has been the belief that the program would reinforce and develop greater independence and autonomy on the part of students since they were self-paced -- they decide when to see an aide, a teacher, score a test, etc. Ideally, we should have tried to measure this directly by observing and measuring student behavior, but as a substitute we asked two questions. The first question was designed to reflect whether students' preferred mode of classroom activity was influenced by IPI. The results, shown in Table 10, suggest that it was.

(15) The part of school I enjoy most is

☐ (a) when we meet in small groups.

☐ (b) when I work by myself.

☐ (c) when we listen to the teacher present a new lesson.

Table 10

Percent of Students Responding to Item 15						
	School A	School B	School C	School D	School G	School H
Small groups	19	37	28	39	32	35
Work by myself	60	37	39	21	40	30
New lesson	22	22	28	40	22	18

In each of the three pairs, a greater percentage of IPI students preferred working by themselves to any other choice and to the number who preferred this mode in the comparison schools.

But working alone is not, by itself, necessarily an indication of independence or autonomy. An equally important question is, what do students do when faced with a problem or obstacle? To pursue this we asked,

(21) Please put a check in the box by the sentence that describes what you do when you are working on a worksheet and do not understand what to do.

☐ (a) Ask the teacher

☐ (b) Ask another student

☐ (c) Keep trying to figure it out by myself

☐ (d) Skip it

The responses to this question present a somewhat different picture. They are shown in Table 11.

Table 11

Percent of Students Responding to Item 21						
	School A	School B	School C	School D	School G	School H
Asks teacher	58	44	57	49	45	38
Asks student	07	13	07	08	11	08
Figure it out myself	31	38	21	37	30	47
Skip it	01	02	08	06	10	01

In each of the three pairs of schools, a greater percentage of non-IPI students reflected an independent attitude: "figure it out for myself." IPI students more frequently chose "ask the teacher" suggesting, quite directly, that a dependency on teacher assistance is as great, if not slightly greater, than that existing in comparison schools. A noteworthy finding is that this dependency on the teacher seems positively related to ability level in the IPI schools -- the higher the ability level, the greater dependency on the teacher. It is still possible, however, that a high ability level child could check "ask the teacher," but, in fact, see the teacher less often than the lower ability student who generally checks "...figure it out by myself," because the lower ability student may more frequently not understand what to do. The results to Item 21, by ability level, are shown below in Table 12.

Table 12

Percent of Students, By Ability Level, Responding to Item 21						
	School A	School B	School C	School D	School G	School H
Asks teacher	49 56 65	46 42 42	54 57 68	50 57 46	42 42 53	28 44 41
Asks student	12 06 04	18 07 15	12 08 03	10 05 08	18 08 09	12 09 05
Figure it out myself	29 36 27	25 46 39	21 19 15	40 30 42	27 30 28	44 47 46
Skip it	00 02 02	04 00 04	09 06 08	00 08 04	09 13 06	04 00 00
	LO AV HI	LO AV HI	LO AV HI	LO AV HI	LO AV HI	LO AV HI

Summary.

In this section on student attitudes we have tried to show that students very clearly and in significant numbers like IPI, and that the structure of the program is attractive to students of all ability levels and, encouragingly, especially to low ability students. We also showed that IPI students quite accurately recognize its structure and its salient feature -- opportunity for each student to advance at his own rate. As in the first year, the IPI reading program lacks the saliency of the math program and, perhaps, is not as distinguishable from other reading programs as IPI math is from other math programs.

There is little or slight evidence that IPI reduces inter-student competitiveness, increases self-reliance on the part of students, or actually enhances the intellectual or substantive facet of the subject matter. Overall, however, the questionnaire data and our own subjective observations strongly support the idea that IPI is popular and motivational.

As an additional dimension to the description of student attitude, we decided on a series of intensive interviews with a handful of students. Following is a report of this activity.

Five Students in IPI: A Series of Interviews*

Introduction. A number of "objective" measurement devices were used to evaluate the IPI program. However necessary such devices may be, they measure changes in achievement rather than changes in student response to the overall school environment.

Does a child become more or less competitive in an IPI program? Does the student become more aware of where he is relative to other students when he works at his own pace? Does such an awareness interfere with his ability to involve himself with the substance of the educational process? These are difficult questions for which we do not have answers, nevertheless, they seem too important to ignore. Thus, it seemed useful to get something of a "kids-eye view" of IPI and to draw what limited inferences we could from what these children did and did not say to us.

We were faced with the difficulties of obtaining this sort of subjective information from our student population while still avoiding a repetition of last year's student interviewing in which we were told little more than what the children expected we wanted to hear. We felt, therefore, that a series of consecutive interviews with the same children over the school year might enable the interviewer to establish some rapport and that a stronger relationship between the student and interviewer might develop. The results of five such interview series are presented. Due to a limitation of time and staff, interviews were conducted with only two IPI schools. Students in Comparison schools were not interviewed.

Three of our interviewees are from School A - a newly constructed school located in a predominantly white upper-middle class neighborhood - where IPI programs in both math and reading are conducted. The other two interviewees

*All interviews conducted by Mrs. Barbra Castro.

are enrolled at School C - a school in marked contrast to School A. School C is in a school district with limited funds and reflects some of the problems concommitant with a low budget, i.e., crowded and antiquated facilities.

All students interviewed are in the fourth grade (a decision arbitrarily made by the interviewer) and have completed their first year in the IPI program. Three interviews were held with each student at intervals of six weeks, beginning in January. It is our belief that these case studies are informative and we strongly regret that our evaluation did not place a greater emphasis on this source of information.

D. L. is a sweet, earnest child who generates warmth and an eagerness to please. Paramount to our three interviews was her wish to give the correct answers to my questions; her efforts to please me color some of the information she offers.

D. L. is a student who has had moderate past success in school. She views herself as a conscientious worker who could work harder, a student who should do better than she has, but who is constrained by a lack of confidence. D. identifies herself as a poor math student and is generally uncomfortable with this subject's content. Her favorite school subjects are language and reading, and she describes her attitude towards both as "more relaxed." I believe that D's preference for the above subjects reflects a greater ease with information that can be memorized rather than material that must be handled conceptually.

D's feelings towards IPI are positive. She views IPI as a means of making arithmetic more palatable. IPI is seen as a "good routine," a method which presents "short-cuts," and as a package of small sequenced-steps which may be easily digested. Thus, D. sees the program as making arithmetic

easier and consequently less threatening. D. describes IPI as "... a good experience to help you learn more." It is D's belief that she is learning "so many things," and she, as well as the other interviewees, enjoys the variegated manner in which the program is presented.

D. responds to school in a serious and anxious manner. She would like to be a "good girl" and do well, and is frightened by the possibility of failure. D. finds a sense of security in the IPI classroom because she is permitted to work at her own speed. She states, "I like to work at my own speed because some children work real fast and I don't want to have to keep up with them because that makes me nervous." A portion of an interview illustrates what "working at her own speed" means to D.

I: Now could you explain what working at your own speed means?

D: You don't have to be pushed around to do the work and you don't have to be timed.

I. Do you think that before you had IPI you were timed and pushed?

D: A little, because we were told to put our things away and to do something else.

I: Well, the period in IPI ends at a certain time and you have to do something else.

D: Yes, but it doesn't push you. You have it ready for the next day.

It should be noted that D's progress in IPI during this year has been substantial as she has moved from C Level to E Level during the school year. D. seems proud of her advancement but is shy about acknowledging it. She denies any desire to keep up with or surpass the faster students in her class. When asked, "Does it mean a lot to be working on Level D or E?" she answered, "Not really, I just want to be working at the level I should...I think I should be working at the speed I am because I shouldn't be going

ahead of the level I am because later I'd do best." However, D. is sensitive to the progress of others in her classroom and wishes that there was some way of keeping each individual's prescribed instruction private. During our second interview, D. was working on D Level, Standards of Measurement. She was able to identify those students in her grade who were working on E Level and felt pressured by them. (It should be noted that D. works in an IPI classroom that has about 65 children.) D. felt "put down" by these students. It was her feeling that they had now reached a level of maturity and perceived the slower students as "babies."

D. is aware of the competitive potential of IPI but shys away from this type of involvement. I again quote from a portion of our interview to capture D's feelings.

I: How do you feel you're doing, as compared with most of the children in the class?

D: I think good.

I: Does this make you feel good?

D: Yes. There's one girl in our class, she's in F Numeration.

I: Is she ahead of B. W.?

D: Yes, the two of them are racing each other.

I: Do you think it is fun to race?

D: No, because sometimes you make too many mistakes and a lot of kids don't even go over it.

I: Well, for some kids, do you think that it makes being in IPI more fun, being able to race?

D: I don't like the idea of racing.

I: You don't like it, but do you think some of the kids enjoy it?

D: Yes, because they want to get ahead of everybody.

I: But you're not interested in getting ahead.

D: No, I'm just interested in getting it right.

The IPI student is repeatedly exposed to a prescribed set of tests. It was my feeling that such frequent testing would create a great deal of anxiety for D. I explored this with her.

I: It seems that you have to take a lot of tests. It seems that a student in IPI takes a lot more tests than, say, a student in a regular classroom. Would you agree?

D: Yes.

I: And what do you think about all of those tests? Does it bother you?

D: No, I'm just calm.

I: Does it become a routine?

D: Yes.

I: Do you think it makes taking other tests easier:

D: Just in post-tests and pre-tests, I'm afraid I won't pass it.

I: What do you think is the difference?

D: Well the CET is just for the skill, but the others are for the whole thing.

I: Do you think that you will forget what you've already done?

D: Yes.

I: Which do you like better, working on the worksheets or taking the test?

D: Working on the worksheet.

I: How come?

D: Because you keep getting nervous waiting for the clerks to call your name to see if you passed it. On the worksheets you get to work as long as you need and figure them out.

I: But you can work at your own speed on the post-tests. Do you find that you don't do that? Do you work faster on the tests than on the worksheets?

D: I try to, but I also go over them when I'm finished.

I: Why would you work faster on the post-test?

D: I'm anxious.

I: You're anxious to get through with it and see how you did?

D: Yes, that's how all of us kids are.

It would seem from the above that taking the post-tests, pre-tests, and CETs are not a manner of routine for D. However, during an earlier interview she lists taking tests as one of the things she likes best about IPI. She quickly qualified this by adding, "...but I'm afraid I'll flunk." This ambivalence seems worth thinking about. In the conventional classroom a child merely passes or fails a test. His test results do not usually direct his next task, but rather give him and his teacher a measure of how much information he was able to grasp during a particular exercise. A student who fails a test will usually follow his class to the next unit. In IPI, the tests not only provide an indication of how much information the student has absorbed, but also determines whether he will advance along the IPI continuum, will remain at the same point, or whether he will be forced to retreat.

I have attempted to convey an image of a child who desires to do what is expected of her. D. views herself as a passive receptor in the learning process and is uneasy with any conditions that subvert her basically authoritarian conception of the pupil-teacher relationship. It is dissonance-producing to have to correct your own worksheets, and D. reveals her dislike for this activity. In response to a question about correcting her worksheets

she says, "I don't like correcting because you don't like to see your mistakes." Just as in the instance of wanting to get her post-test over and done with, D's dislike for scoring her own worksheets seems prompted by her desire to remove herself from a situation that would heighten her fear of failure. This fear keeps D. conservative. It is my feeling that IPI has been conforting for D. Unlike the other students interviewed, the program seems to have released her from some of the pressures she has experienced in the past and allowed her to accept her own level and to work at her own speed.

R. L. is a reserved child who looks younger than most of the 4th graders in his school. Unfortunately, from the point of view of these case studies as well as my own ego, I was unable to establish any rapport with R. Scanning the typewritten texts of my taped interviews, I was faced with a series of "yes's," "no's," and "I don't know's" given as responses to most of my questions.

R. attends a school where IPI math was being used. He is a good, thorough student who has experienced success in IPI as well as his other school subjects. I believe that R. provides both an interesting contrast and likeness to I., the other "high achiever" whom I interviewed. While I. is bold, R. is shy; whereas I. is boastful, R. is modest. I found I. bent on being a "winner," a "star." R. seemed "cooler" about his success and less concerned with being on top. However, in spite of differences in style, both students seemed to approach IPI in the same manner and to enjoy the same features of the program.

As in the case of I., R's favorite school subject was math. Also like I., he felt IPI made this subject even more enjoyable. It was R's feeling

that he was learning more math this year than he had in the past and the notion of "learning more" was important to him. R. relished the chance to work at his own speed, or in his words, to work "as fast as you can." As was true of I., R. had felt hindered by slower students and now responded positively to the freedom of moving as quickly as he could. Examining R's folder, I found that he did move swiftly and work hard. In the classroom situation (which was noisier and more chaotic than that in which I. worked) R. was diligent and engrossed. While R. had begun the school year working on C Level, Numeration (one level lower than I.), he mastered an equal number of levels, ending the school year working on Level F.

R. appeared to be an independent student and responded well to the self-governing aspects of IPI. He expressed positive feelings towards working alone, correcting his own worksheets, and the availability of the teacher for consultation at his choosing. The latter is important, for R. found the teacher to be more accessible to him in the IPI situation than in the conventional classroom. In the IPI classroom the teacher functions (aside from her disciplinarian duties) as an information disseminator, either providing the student with assistance in areas that he does not understand, or directing him to his next step. Thus, the teacher's role in the IPI classroom is different from her role in more conventional settings. R. is the only one who touched on these differences, and the fact that he perceived them may be a function of his shyness. Perhaps the more reserved student senses a greater opportunity for a one-to-one relationship with the IPI teacher -- specifically, providing the possibility of a private discussion of his work. I believe this relative sense of privacy is prized by R. and accounts (their many charms aside) for his partiality to the IPI teachers.

R's overall impression of IPI was that it was "easy" and "fun." He would like to have all of his school curriculum presented in the IPI format. When I asked R. to list "what I like best about IPI," he enumerated the following:

"1) the work
2) the teachers
3) CETs
4) post-tests
5) pre-tests
6) the clerks"

R. has enjoyed the many tests in IPI because they symbolize either the end of a unit of work or the beginning of new material. In either case, there is tangible reinforcement for mastery -- an aspect of the IPI program which has been recognized by a number of the students interviewed. Interestingly enough, R. also lists test-taking as a feature of IPI that he <u>does not like</u>. Once again I am struck with the ambivalence that tests elicit from these students. Inherent in test-taking is the potential for failure, indicating that you do not understand your work or (most probably for students in this age group) that you must go back over material that you thought you had completed. The only other complaints that R. offered was the size of the IPI class and the subsequent noise that he had to contend with.

While I was able to learn little about R., he seems to bear out my feeling that the more successful a child has been in IPI, the greater is his liking for the program. R., like I., is sold on IPI, and for these children IPI will probably offer an opportunity for greater achievement and self-development than was provided in the conventional classroom.

I. H. was chosen for interviewing because of his articulateness and high scholastic performance. Background information for this child is interesting and pertinent. I. and his family arrived in this country from Europe two

years ago. Upon entering the American school system, I. was placed in a third grade class. As he had already completed his third year of schooling in Europe, he viewed this as a gross injustice and an impediment to his progress. Perhaps this is a contributing factor to the zealousness and drive to achieve which seems characteristic of him.

I found I. to be a charming, alert, and verbal interviewee. He is positive in his approach to himself and to school. Upon meeting, I. informed me that he thought he had been selected for interviewing because of his brightness. When I asked the question, "What level are you working on in math?" he replied, "A very high fourth grade level -- E Level. I'm much higher than all of the other students because I'm much smarter."

"It's best to be the highest one." "... you always want to set a record, be one of the smartest." This, in I's words, is an assessment of what sustains him in IPI. I. is a highly motivated, achievement-oriented individual who enjoys a game played with competitive stakes. The IPI program is a magnetic experience for such a student. I. sees IPI as a fast means of learning math, and enjoys the absence of external hindrances such as slower students or repetitious classroom teaching. He states, "With regular math that you do in a classroom you have to work on another guy's level. If you're a smart guy, you work on a lower level because the teacher's trying to teach the children that don't know as much. In IPI math you can just go along." The opportunity to work along at an uninterrupted pace determined by the student himself pleases I. Mechanical incumberances inherent in the program interrupt his rhythm and disturb him. Thus he tells me: "There is one thing that I hate about prescriptions. That's all that bothers me. That is waiting in line." He views this as wasted time. Extra assignments given

during this waiting time are seen as annoyingly irrelevant to his immediate task (i.e., taking the appropriate tests and moving on to the next step). His solution (he has given it some thought) is to handle these details through the use of a computer. He states, "I wish they had a machine where you just had to put your folder through and there would be a prescription there."

I's interaction with the IPI program appears to be positive. He understands the system well, has used it optimally to fulfill his needs, and thus far has met with success. However, he is a student who has had continuous success in his entire school experience. It would seem that for such a child "programed learning" not only succeeds in imparting subject matter but also offers him the opportunity for further independence. During the school year I was able to observe I. in the classroom. I found that he used his time efficiently and was thoroughly engaged in his work. There were few "coffee breaks" except for the occassions when he was on line. (Perhaps an appropriate argument for the inclusion of lines.) I do not mean to imply that this was not an independent child before IPI. I do think that a child who enjoys working alone and is able to determine when he needs assistance is given sufficient freedom to exercise and develop this initiative and self-reliance within IPI.

An interesting aspect of IPI is its potential competitive quality for those who choose to compete. (In some of the interviews which follow we shall see that competition within IPI is not always a matter of choice.) In a small group situation (by this I mean a situation where there are no more than thirty children working together, and hopefully less) each student's progress is a public matter. While this may also be true in a conventional classroom, working in a slower group does not as dramatically delineate

your lack of progress as being a fourth grader working on C Level at the close of the school year. I. is sensitive to his own achievement in terms of the achievement of his classmates. He explains, "I know who's smart and who isn't smart, and then I ask all of the smart guys." The IPI program, with its carefully stepped curriculum, provides both teacher and student with precise information of how the student compares with others. I. is able to assess the so-called "top guys" in the class and then attempt to do better. However, he (as well as the other children interviewed) is not foolhardy and is aware of the pitfalls of moving too quickly. Overzealousness will result in a poor showing on a CET or a post-test. Thus, an awareness of how fast one can move without "goofing up" must be developed.

While I. participates in both IPI reading and math programs, his discussion centers around his math experience. Although his reading performance is high, his preference is for math. He offers this explanation. "They're both the same, but I'm better in math because I come from another country so I don't know the language so well. So reading is harder for me than math." It is also speculated that IPI reading does not offer as much immediate reinforcement for success. The reading skill units are longer, which keeps the student working on the same level for a greater period of time. As a result, advancement appears to be slower and less exciting.

During one of my interviews I asked I. to make a list of the things he liked best and least in IPI. Perhaps they best summarize this student's appraisal of IPI. I's list of what he liked best about IPI follows:

"1) You can go as fast as you like.
2) There are more things that you learn in a level than with a math book.*
3) You have to listen to something the teacher is explaining to another child."

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*I. explains that if you look at a third grade math book (which was his last experience with a math book) it will contain addition, subtraction, multiplication or division. The IPI curriculum treats such areas as Geometry, Special Topics and Standards of Measurement.

He was least pleased with his folder "getting lost in the aide's office" and with "having to wait in line because while you wait its hard to find something to work on."

I. would improve the IPI program by adding (1) more aides, (2) more teachers, and (3) computers.

K. is a friendly, distracted young lady who enjoys talking generally, but avoids discussion of her school experience. Thus, my notes reflect many of K's impressions of television personalities and relatively little of her reaction to IPI. She is a student who is bored by school and has been stimulated by very little. K. views school as a necessity which may provide some future payoffs but which certainly offers few immediate rewards.

As part of our evaluation of the IPI program, each child was asked to answer a written questionnaire. Upon reading K's questionnaire I was struck with the discrepancy between her responses and what I perceived to be the reality of the situation. As an example, K. checked the box "when I do IPI reading I do better than most of the other students in my class." The other choices available were: "I do as well as most of the other students in my class; I do not do as well as most of the other students in my class; I do not know how I do compared to the other students in my class." In fact, K. does not do better than most of the other students in her class nor does she really believe that she does better. Her dishonest response to the questionnaire seems to me to reflect a great deal of anxiety about her relative lack of progress. Her apprehension that she has been selected for interviewing because she has "done something wrong" may be interpreted in the same way. K's past performance has been unsatisfactory to herself as well as to her teachers and she has been told "to do better, to work harder." These admonishments, which have been difficult to incorporate, lurk over her and keep her uneasy.

As the school year progressed, K. demonstrated little success with IPI. Subsequently, her feelings about the program reflect frustration and despair. K. is involved in both the IPI math and reading programs. She prefers the latter, in large part, because she enjoys the library, giving oral reports, choosing books she wants to read, and using tape recorders and typewriters.

At our first interview, K. said that she was doing better in IPI reading than math as she was working on Level E in reading as compared to Level D in math. It is interesting that K. was not aware that all of her classmates began working on Level E, and that, in fact, this was the lowest level available. I wonder if this false sense of success is accountable for K's preference for reading and whether she is caught in the trap of enjoying only that in which she does well. Although K. expressed a greater liking for reading, she seemed to be more involved in the math program and the discussion of the latter dominated our interviews.

K. began the school year working on Level D in IPI math. During the month of March she remained on D, having moved from Numeration to Standards of Measurement. In this period she failed her post-test on a particular skill twice. She complained vigorously about post-tests, charging that the directions were difficult to understand, the print was smeared, and the problems found on the post-tests did not represent those on the worksheets. As I found it peculiar that a child should fail a post-test twice after successfully completing a set of worksheets, I questioned K. further. She explained that IPI was hard, agreed that she probably did not understand the material, and informed me that if she continued to fail her post-tests she would have to return to Level C.

At this point K. was in a tight situation. She wished to advance and was stymied in her progress. In addition, she faced the possibility of being put back a level. This was a humiliating and ego-deflating possibility that K. viewed as tantamount to being a "baby." (K. had established a hierarchy of development which she equated to the various IPI letter levels. In her scheme, Level C was equivalent to being a "baby," Level D was seen as being "a little more grown up," and Level E was comparable to "being a teenager.") During the beginning of the school year K. had been in competition with L., another interviewee. Their progress had been about equal and they had earmarked each other as rivals. In the interim, L. had moved ahead. When questioned about L's advancement, K. said she felt "sad," "terrible," "like all my cells are breaking." These are poignant words and reflect the feeling of a little girl who desperately wants to move along and keep up with the other students. I believe that K. had attempted to remedy her problem by cheating and later found this self-defeating. I explored this with her:

I: Could you explain how you correct your worksheets?

K: The keys tell you the answers and if they don't you go to the aide or the helper and they help you find the sheet. You can't cheat because the teachers always look through it to see if you cheat because they have been catching people who cheat.

I: Is there a lot of cheating?

K: Yes.

I: Is it easy to cheat?

K: No.

I: Did it used to be easy to cheat?

K: No.

I: How do the teachers check?

K: They go through your papers to see, if they've been hearing a lot about it.

I: Why do you think people cheat?

K: Because they want to go up into a higher level. It doesn't matter what level your friends are in. You have to learn the level you're in well before you get ahead, and it's the learning that's important. If you cheat you're not going to learn anything and the teacher will find out sooner or later.

I: Well, the place they find out is when they get the post-test right?

K: Yes. If she flunks it they'll know that you're cheating. They know what words you don't understand. If you don't do what's right you're just going to flunk other classes.

I: Do you think that other children in the class understand that?

K: Yes, some of them understand that.

I: Have you understood that all along with IPI or are you just beginning to understand?

K: I understood it from the beginning. I wanted to cheat in the 3rd grade in the beginning but I told myself no, because they'd find out and then they'd flunk me.

I: Do you like correcting your own worksheet?

K: Yes.

I: Would you rather have somebody else do it for you?

K: No. I don't like anyone else to do it but I like the teacher to watch over me sometimes just to check and help me to learn more about it, <u>maybe send me back to another level</u>.

I: Why do you think some of the children don't like to correct their own worksheets?

K: Probably because they don't like to cheat. They want to cheat, but they don't like to.

I: Do you think that's the most important reason for not wanting to correct their own worksheets?

K: Yes, because you want to cheat so bad but you know you can't.

Unlike D. who had accepted IPI's ability to let the student work as fast or as slow as she wants, K. had panicked and responded frantically to IPI. Such panic may well have been self-fulfilling as her preoccupation with "keeping-up" could well have left her unable to concentrate on what was to be learned. Thus a stage was set for cheating. Fortunately, K. discovered that this was not a solution to her problem and we began to see a "cooling down" of her frustrations and the beginnings of constructive rationalization. "It doesn't matter what level your friends are in. You have to learn the level you're in well before you get ahead. It's the learning that's important." are amusing evidences of brainwashing. However, if this sort of thing could be internalized it would save K. some pain next year.

Now at the end of the school year, K. is back in the running with L., her former rival, and much happier. She has mastered a level and may even have learned some math. Presently, what K. likes best about IPI is passing; what she likes least is failing. A simple but quite complex dilemma.

L. is cute, cynical, and "tells it like it is." Unlike the other interviewees at his school he was not interested in impressing me and was even a bit put out by our interviews as he was forced to miss a portion of

recess each time he saw me. He was described by his teacher as an "average student" and was selected for interviewing because of this.

During our first interview L. listed his favorite school subjects as history and science. As a third favorite he offered spelling. I categorized these preferences as anti-IPI in nature, because the other two major school subjects in his elementary school curriculum, math and reading, were presented in the IPI format. Initially, what L. liked about IPI may have reflected his dislike for school, rather than any positive attributes of the program. At our first meeting L. informed me that he liked IPI because "the teacher doesn't bug you and you don't get any homework."

L. could take school or leave it. He viewed teachers (and interviewers) as wielders of authority who one had best stay clear of. As was true of K., he feared that he had been selected as an interviewee for negative reasons, specifically because, "I get everything right on my worksheets but fall down on my CETs." L. could not understand why this discrepancy existed. He saw such a predicament as unpleasant, because of the frustration of having to repeat the same material, and because of the anger evoked from his teacher. Of course, I was later to find (but not from L.), that the inconsistency in his performance was attributable to cheating. L. was either giving himself credit for wrong answers or changing his wrong answers to the correct ones provided by the keys.

At the time of our first interview L. was working on Level D, Fractions, in math and Level E, Phonetic Analysis, in reading. Six weeks later he had almost completed Level D, was anticipating his jump to Level E, and seemed tickled. Although I may be guilty of over-interpretation and a zealousness to draw neat conclusions from limited data, I seemed to observe a marked change in L's attitude towards IPI. Whereas at first he had appeared

indifferent, he now seemed involved and a convert. While he still listed IPI's most positive feature as the absence of teacher coercion, L. now found that programmed instruction made math and reading more challenging than non-IPI subjects as there was an impetus to keep working, or in L's terms, less of a tendency to "goof off." L. now expressed a desire to have all of his school subjects presented in the style of IPI.

Beginning Level E meant that he was "moving fast." As was true of other IPI students, L. wanted to forge ahead to the next level. The IPI student is given a goal. L. states it as, "You try to go high before school is out." A portion of a transcribed tape clearly demonstrates the drive to get beyond the next level and the accompanying competitive spirit that prevails among L. and other IPI students.

I: What about correcting worksheets? I understand that in IPI you do this.

L: We can correct our worksheets but we can't correct the CETs or the Pre's and Posts. The aides do that.

I: What do you think about correcting your own worksheets?

L: It's okay.

I: Is it something you enjoy doing or is it a chore?

L: It's fun to do. You get to do your own pages. You don't have to wait around all the time.

I: If you had a choice between having your teacher correct your worksheets or correcting them yourself, which would you choose?

L: I don't know.

I: I've talked to some students who said they didn't like to correct their own worksheets because there was a temptation to cheat. Does this happen?

L: Cheating? Some guys just get out the grade book when they get finished with their worksheets and put down 100%. Or they take the answers out of the book.

I: Does this happen often?

L: No because once in a while they get caught by the teacher.

I: It would seem to me you would get caught all the time when you take the post-test.

L: You can't copy the post.

I: No, but if you went through and copied the answers for the worksheets then took the post-test and failed it would seem pretty evident that you didn't understand the material when you couldn't answer the question of the post-test. So you'd get caught that way, right?

L: Yes.

I: What do you think makes some of the students cheat?

L: They want to get out of there fast.

I: Why is that?

L: Because they want to go to a new level.

I: Why is it important to move fast?

L: They just like to be with their friends.

I: Do you think one of the reasons that people keep working and pushing ahead is that they are in a race with their friends?

L: Yes.

I: How do you know what the other students are doing?

L: After math we have recess and they tell us what they are doing.

Like the other interviewees, L. views keeping up with the other children as paramount. However, conforming seems to be a selective process having very realistic boundaries. L. recognizes I's prowess in IPI, feels outclassed by his ability, and expresses no desire to compete or outdistance him. What matters to L., as well as the other students interviewed, are gains or losses

in their relative standing. Thus within the legitimacies of equal ability levels, etc., there is an intense competitive pressure.

As we have already noted, the series of interviews we held with a very small number of IPI students was more interesting and suggestive than we had initially expected. Interviews are no way to determine how much information the student is obtaining and retaining from the IPI material he studies. However, many other questions about IPI's effect on the student were raised. Does IPI create and/or support greater competitiveness than other school situations? In what ways would such an increase in competitiveness be a general asset or liability? Do various sorts of students respond to competition in systematically different ways? Is the relationship between an IPI student's sense of progress and achievement and the rate of progress and achievement of his peers different from the analogous relationship in an ordinary classroom situation? Will the size of the IPI classroom and the grouping of students according to their ability levels affect how the IPI student proceeds with his material? These questions deserve serious analysis and all we are able to provide are the most tentative sorts of suggestions. However, these suggestions are a starting point and our emphasis on them correctly connotes our belief that they should be taken further.

Judging from the small sample of children interviewed, we are inclined to believe that IPI facilitates a greater awareness of the student's standing vis a vis his classmates and hence a greater pressure to keep up with or exceed their performance. Handled properly this competitive pressure may be a constructive force, providing incentive and interest; handled poorly, as in the case of K., and less dramatically with L., it may be a destructive distraction from the real substance of education.

II. Teacher and Student Classroom Activity and Interaction

Of natural interest in evaluating a new curriculum is the child's daily activities. How does he actually spend his time during a given class period? We would expect that IPI would affect this variable, and we set about measuring it by developing an observation schedule and an experimental design. The schedule (slightly different for IPI and Comparison schools) and results for the four IPI and four Comparison schools are presented in Tables 13 and 14. Results are expressed in percentages for ease of comparison. The design consisted of the random selection of 10 children from the roster of a class we had selected for observation. We then randomly assigned each of the total minutes of the class period to the ten pupils so that each was observed on an average of three or four times a period, each observation lasting one minute. During that minute, a child could be recorded as being involved in one or more of the activities described on the observation schedule. We observed each class for five days, in most cases five consecutive days. The range of observations on the 10 children was from 206 to 294 for the 5-day period.* On this basis, we are able to describe the activities of the "typical" child during a typical week of school with confidence that we are not presenting a biased choice of the children observed, the time when they were observed, and the amount of time they were observed.

Before discussing and commenting on the results, a number of cautionary remarks are in order. In School A, the IPI reading school, part of the reading period was spent by part of the class in the school library. In most cases, the children were there in compliance with their IPI prescription and so we scored this activity as "working independently on worksheet," even

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*Certain deviations occurred because the length of the class period varied from 25 to 60 minutes.

though this was literally not true, and even though some of this time might be spent in actually searching for books, references, etc. This might inflate the amount of time spent on "independent work." A second cautionary note pertains to School E. For reasons unclear to us, a regular IPI period was held every other day and a regular math class held on alternative days. However, as we described in the introduction, these regular periods were referred to as IPI "seminars" even though the whole class met together and the topics, during our observation time at least, did not seem particularly integrated into the IPI program. Thus, the weekly activity for a typical child in this IPI program would be expected to vary considerably from other IPI programs. A look at the data in Tables 13 and 14 indicates this to be true. These percentages reflect the distribution of activities of a typical child over a typical week's period of time. For example, in School D the typical child spends 19% of his time working independently, no time working with his teacher, 20% in non-instructional activities, no time with other students in an instructional relationship, and 58% of his time as a member of a total class interacting with a teacher.

Finally, one of the teachers in School H had developed her own individualized program which enabled her to interact more frequently with individual children. She virtually dispensed with total class activities even though she did not have special materials. On a daily basis, she assigned individuals work to do in different sections of the text based on her knowledge of them and their progress.

Allowing for the conditions just described (in IPI Schools A and E, and Comparison School H) we present the following conclusions.

Table 13

Observation Schedule of IPI Classroom Activity Categories:
Percent of Students in Each IPI School Working in Each Activity

	School			
	A	C	E*	G
I Independent Work				
Child is:				
1. Working independently on worksheet	52**	22	23	26
2. Using visual aids or manipulative devices	00	01	03	00
3. Correcting worksheets	02	06	01	04
3a. Using course requirement material	00	00	00	00
4. Working on a pre-post test or CET	02	12	03	09
5. Not doing anything related to IPI but working on school work	01	00	00	00
TOTAL PERCENT: INDEPENDENT WORK	57	41	30	39
II Teacher-Pupil Work				
6. Seeking reassurance from teacher or aide	01	00	00	01
7. Seeking direction from teacher or aide	02	01	01	01
8. Seeking instruction from teacher or aide	02	01	01	00
9. Receiving individual instruction from teacher or aide	01	01	03	03
10. Receiving small group instruction from teacher or aide	01	02	00	01
11. Being disciplined	01	00	00	01
TOTAL PERCENT: TEACHER-PUPIL WORK	08	05	05	07
III Non-Instructional Use of Pupil Time				
12. Socializing or wandering around	08	16	09	09
12a. Left room	00	00	02	04
13. Getting prescription written	01	01	00	05
14. Gathering materials	06	05	02	05
15. Waiting in line to see teacher	04	08	00	08
16. Waiting in line to see aide	04	09	03	07
17. Raising his hand for assistance	00	00	03	00
18. Getting tests corrected at aide station	01	03	02	05
18a. Not doing anything but remaining at seat	12	11	12	09
TOTAL PERCENT: NON-INSTRUCTIONAL USE OF PUPIL TIME	36	53	33	52
IV Pupil-Pupil Activity				
19. Receiving or giving help on worksheet from/to another child	01	05	05	02
V Large Group Activity				
20. Listening to teacher lecture or demonstration	01	00	15	02
21. Participating voluntarily (includes raising hand) in question-answer exchange	00	00	10	00
22. Answering question directed to him	00	00	02	00
23. Not participating in question-answer exchange	00	00	05	00
TOTAL PERCENT: LARGE GROUP ACTIVITY	01	00	32	02
Total number of observations at each school	294	273	238	206

*Includes "seminar days" which are actually conventional classroom periods.
**Includes library time.

Table 14

Observation Schedule of Comparison Classroom Activity Categories: Percent of Students in Each Comparison School Working in Each Activity

	School			
	B	D	F	H
I Independent Work				
Child is:				
1. Working independently on worksheet	36	07	29	45
2. Using visual aids or manipulative devices	02	00	00	00
3. Correcting a study exercise or test	00	01	00	01
4. Taking a group test	00	11	00	01
5. Not doing anything related to scheduled subject but working on school work	09	00	01	00
TOTAL PERCENT: INDEPENDENT WORK	47	19	30	47
II Teacher-Pupil Work				
6. Seeking reassurance from teacher or aide	00	00	00	00
7. Seeking direction from teacher or aide	01	00	01	01
8. Seeking instruction from teacher or aide	00	00	01	02
9. Receiving individual instruction from teacher or aide	02	00	01	14
10. Receiving small group instruction from teacher or aide	02	00	01	07
11. Being disciplined	00	00	01	00
TOTAL PERCENT: TEACHER-PUPIL WORK	05	00	05	24
III Non-Instructional Use of Pupil Time				
12. Socializing or wandering around	11	02	08	06
12a. Left room	02	00	01	00
13. Gathering materials	06	03	06	04
14. Waiting in line to see teacher	00	00	02	00
15. Waiting in line to see aide	00	00	00	00
16. Raising his hand for assistance	00	00	00	04
17. Getting test corrected	00	00	00	00
17a. Not doing anything but remaining at seat	06	15	15	10
TOTAL PERCENT: NON-INSTRUCTIONAL USE OF PUPIL TIME	25	20	32	24
IV Pupil-Pupil Activity				
18. Receiving or giving help on worksheet from/to another child	09	00	04	07
19. Working in a small group without teacher	00	00	17	00
TOTAL PERCENT: PUPIL-PUPIL ACTIVITY	09	00	21	07
V Large Group Activity				
20. Listening to a teacher lecture or demonstration	06	39	02	01
21. Participating voluntarily (includes raising hand) in question-answer exchange	02	08	02	04
22. Answering question directed to him	01	05	03	02
23. Not participating in question-answer exchange	04	06	01	00
24. Working independently on group-based activity	03	00	00	00
TOTAL PERCENT: LARGE GROUP ACTIVITY	16	58	08	07
Total number of observations at each school	243	217	235	207

1) How a child spends his time in class is more a function of the individual teachers than of the curriculum; there is as much variability within the IPI and Comparison school groups as there is between them.

2) There is considerably less instructional time spent as part of the total class in IPI than in regular classes; except for School E, as noted above, IPI virtually dispenses with this form of classroom organization.

3) Except for School A, again as noted above, the typical child in IPI spends less than half of his time actually working on his own. The amount of time he spends working independently on a worksheet* (the basic instructional media of IPI) ranges between 22%-26%. This is lower than one would expect from the structural properties of IPI and, overall, except for one class in School H, is not appreciably different from the amount of time a child in a non-IPI school spends working independently on a worksheet.

4) A given child in either program rarely spends any time alone with his teacher. Except for School H (24%), five percent or less of a child's time is spent with his teacher. This does not mean that teachers do not spend time with individual students; it merely indicates that the individualization in IPI does not change any one child's individual contact with his teacher. He is as likely to interact singly with a teacher in a conventional class as he is in an IPI class. The 24% in School H can be partially explained by the one teacher who had individualized her program.

5) IPI is successful in reducing to almost zero the time a child spends as a member of a total class undergoing a single lesson. As a generalization, the following is reasonable:

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*Worksheet includes CET's and Pre-Post tests in IPI.

In an IPI class a child is either working on his own worksheet (including CET's and other tests) or is waiting to do something, i.e., not doing anything productive. In a non-IPI class, a student is either working independently, participating in a total class lesson, or doing nothing productive. The generalized estimates of the major blocks of time look something like this:

	IPI	Non-IPI
Independent work	42%	36%
Non-instructional	44%	25%
Total class	09%	22%

6) School C and School G have the greatest problem of non-instructional time. Interestingly, both these schools are similar in that they have two or three teachers who handle all the 4th, 5th, and 6th graders in the school for math instruction. It may be that such an arrangement is inherently wasteful of children's time despite whatever other organizational and pedagogical advantages it may have.

Postscript. After these observations were made, a group from Research for Better Schools in Philadelphia visited the IPI schools, were made aware of the "waiting time" problems, and suggested some changes. In one school, when children came up to an aide who was busy he was given a number and returned to his seat to work on some supplementary material. When his test was scored, his number was called. This probably increased the amount of independent work time.

Teacher-Student Interaction:

In the first year IPI evaluation, an observation schedule of teacher-student interaction was developed which showed marked differences between IPI and Non-IPI schools. The interaction categories are shown in Figure 1.

SOURCE AND DIRECTION OF INTERACTION	Content of Interaction: Instructional	Non-Instructional
Teacher → 1 Student		
Teacher → 2 or more students		
Student → Teacher		

Figure 1

We found that IPI led to a substantial increase in student-initiated instructional communications. To verify this, during the second year we observed both IPI and non-IPI classes during a two-week period in May. A total of five hours (each hour in a different classroom) was observed for both IPI and non-IPI classes. For purposes of reliability, we combined all the classes in each group and converted the frequencies into percent of total observations made. This is shown in Figures 2 and 3.

Five IPI Classes

	Instructional	Non-Instructional	Total
Teacher → 1 Student	09%	23%	32%
Teacher → 2 or more students	00%	05%	05%
Student → Teacher	21%	42%	63%
TOTALS	30%	70%	

Figure 2

Five Non-IPI Classes

	Instructional	Non-Instructional	Total
Teacher → 1 Student	23%	14%	37%
Teacher → 2 or more students	15%	14%	29%
Student → Teacher	19%	15%	34%
TOTALS	57%	43%	

Figure 3

Before reporting and discussing the results, it should be pointed out that despite satisfactory observer reliability scores, the observations of last year and this year were made by different individuals and thus comparisons between the first and second year are subject to certain limitations. The IPI and non-IPI comparisons, however, are not.

There are two salient differences in the interaction patterns shown in Figures 2 and 3. The first relates to the source of communication; 63% of all communications in IPI classes are originated by students in contrast to only 34% in non-IPI classes. This finding supports IPI's quest for a less teacher-directed program and repeats last year's finding. The other salient finding is that 70% of all interactions in IPI are non-instructional in content. This is in contrast to a non-instructional percent of 43% in non-IPI classes. It should be pointed out that the actual frequency of interaction between the two treatment conditions was quite similar so that the percentage comparisons are based on almost equal figures. Why IPI interactions are more frequently non-instructional is puzzling, especially since this was not the case during our first year's observations.

III. Student Achievement Over the School Year

We used and analyzed, separately, two different instruments for the measurement of student achievement--the Iowa Test of Basic Skills (ITBS) and the IPI Placement Test. The purpose for a dual criteria was to reflect, fairly, the possible differences in content or emphasis between a conventional program and IPI. To insure this, we administered the two tests to both IPI and non-IPI students. In this way we could best determine whether, as suspected, standardized achievement tests (ITBS) were inappropriate criterion for IPI; If this were true, the IPI groups would show marked superiority in the IPI Placement Tests while showing no advantage or negative standing on the ITBS. On the other hand, if the non-IPI groups showed marked superiority on the ITBS and on the IPI Placement Tests as well, one would have to conclude that IPI, as far as achievement is concerned, is detrimental, or minimally, no better than existing programs.

It seems clear to us that, as a new program, IPI must do more than equal existing programs in student achievement. If it is shown that IPI is only "as good as" programs already in existence, than a decision to accept or reject it must depend on attitudinal, organizational and cost factors, many of which have been discussed earlier in this evaluation. It must be recognized, however, that most educators (and we agree) will place the greatest weight on achievement; thus our feeling that student achievement in a new program must be greater in order for the program to have the desired impact.

One final comment. There are generally misunderstandings as to how to measure change when not everyone starts at exactly the same point. The simplest, but by no means the only way to do this, is to examine the difference between the starting and ending scores for groups of students. Even though there is a distribution of starting scores for each group (some high scores

and some low scores in each of the groups to be compared) the "difference" scores take this into account and are relatively uninfluenced by the absolute starting score between group differences. To clarify this, Table 15 presents an example of actual data collected.

Table 15

$\bar{X}$ Number of Units Mastered on IPI Placement Tests: Pre, Post, and Difference Scores

	Mean Starting (Pre) Score	Mean Ending (Post) Score	Difference Score (Units Gained)
5th Grade	22.47	38.74	16.26
6th Grade	32.87	48.17	15.30

Since we normally expect 6th graders to have higher achievement test scores than 5th graders, a comparison of their starting or ending scores would be unfair. (It should be kept in mind that starting and ending scores, when used in connection with IPI Placement Testing, refers to the number of units mastered on the pre and post tests.) It can be seen that the Difference score, or number of units gained, is independent of the magnitude of the pre-test scores and provides a clear index of gain. It is this index which we will primarily deal with in the remainder of this section.

IPI Placement Tests:

The IPI Placement Tests were not designed as achievement tests but were adapted for this use so that some estimate of performance on IPI material for both IPI and non-IPI students could be obtained.

The IPI students were tested as part of the IPI procedure. The evaluation team tested a random sample of students at each grade level in each of the Comparison schools. The placement test is comprised of 12 sub-tests (addition, place value, numeration, etc.) and there is such a battery at Levels B through G or H. The strategy in administering the test was to have the teacher in

non-IPI classes estimate roughly a student's general level by examining the material. We then quickly scored the tests so that we could return and administer another level, higher or lower than the original. The idea was to find, for each student, the point at which he scored 80% or more on each of the subtests. He received a point for each sub-test mastered at each level (mastery being 80% or more). Thus, for example, a student who mastered all the sub-tests at Level C would receive 24 points; 12 sub-tests x 1 for all of Level C plus 12 sub-tests x 1 for all of Level B. Level A received no credit. The same procedure was repeated during the last two weeks of the school year.

We requested that the IPI teachers follow the same procedure for the sake of the evaluation. Due to some misunderstanding, this was not followed out to completion at School G, necessitating a statistical correction for this school's data which is indicated in the appropriate tables.

In presenting the results of the IPI Placement Tests, we have analyzed the data, first according to ability groups in each school, and then by grade level for each school. To determine assignment to an ability group, the class scores of the Lorge-Thorndike Intelligence Scale were divided into thirds; the upper third we labeled and refer to as the High ability group, the middle third as the Average ability group, and the last third as the Low ability group. Thus a child's designation was determined relative to his class scores and not by a standard applied to the entire sample. In certain classes, especially in the non-IPI schools because the original sample was smaller, the number of students for whom we had a pre and post test plus an intelligence score became quite small so that, as will be seen, certain sub-analyses could not be performed. The data to be presented includes only those students for which we have complete data.

Results. All tables present mean ($\bar{x}$) difference scores. In all cases the difference between pre-test and post-test was statistically significant. That is, every class and every ability group, both in IPI and non-IPI schools mastered more units then could be accounted for by chance. The expected result is important only in the sense that, if any group did not reveal it, a serious question of what occurred during the 8 or 9 months between testing would have been raised. The more important comparison is the difference between the scores of the IPI and non-IPI groups. The mean difference scores (number of units gained) for ability groups appear in Table 16.

Table 16

$\bar{X}$ Difference Scores: IPI/Non-IPI School Comparison by Ability Levels Using IPI Placement Tests

	Lo Ability	Av Ability	Hi Ability	Total School
School C*	8.93	14.74	14.97	12.96
School D	15.64	14.80	15.56	15.05
School E*	6.08[a]	6.88[a]	9.75[a]	7.47
School F	10.67[a]	12.13[a]	14.40[a]	12.93
School G*	10.19[b]	12.04[b]	13.35[b]	11.80
School H	11.95	13.0	13.38	12.63

Mean significantly greater than the group being compared with.

[a] Insufficient numbers to allow for reliable test of differences.

[b] A constant of +2 added to each mean to correct for the test administration error mentioned previously.

*IPI schools.

Inspection of Table 16 suggests the following:

1) In the twelve comparisons tested, the mean number of units gained in IPI schools never exceeded the number gained in the non-IPI counterpart. The uniformity of this trend is statistically significant. There are no reversals.

2) There does not seem to be a systematic interaction between achievement (as measured by the IPI test) and ability level; no one ability group seemed to show any greater or less comparative change than any other ability group.

3) As a generalization, achievement in math by varying ability groups, as measured by the number of units mastered on the IPI Placement Test, is not enhanced by IPI. If anything, it tends to depress achievement somewhat for all ability groups.

4) Theoretically, if all students can work at their own rates in IPI, the high ability students should show a greater gain in the same time span relative to the slow ability group. The data in Table 16 tends to substantiate this. On the IPI Placement Test there is a relatively greater gain for fast students in contrast to slow students than in the non-IPI schools. Whether the relative difference is due, however, to the more rapid movement of the high ability students or to the depressed movement of the slower ability group is a moot point. Certainly the IPI/non-IPI comparison tends to support the latter interpretation.

Looking now at a breakdown by grade level, we present Table 17.

Table 17

$\bar{X}$ Difference Scores: IPI/Non-IPI School Comparison by Grades Using IPI Placement Test

	4th Grade	5th Grade	6th Grade	2nd, 3rd Grade
School C*	14.62	9.03	14.62	
School D	13.44	16.26	15.30	
School E*				7.47
School F				9.93
School G*	10.93[a]	10.45[a]	14.07[a]	
School H	11.61	9.35	17.05	

Mean significantly greater than the group being compared with.

[a]A constant of +2 added to each mean to correct for the test administration error mentioned previously.

*IPI schools.

Conclusions from Table 17 follows:

1) The general superiority of the non-IPI difference scores is seen at each grade level.

2) In Section II we pointed out that one of the 6th grade classes at School H had an individualized, highly motivated program designed by the classroom teacher. It would seem that the results indicate the fruit of her efforts. The mean difference score of 17.05 units is the greatest gain observed.

3) As a generalization, IPI has little positive effect on the achievement of students of different grade levels.

Iowa Test of Basic Skills (ITBS):

For simplicity we analyzed the difference score of the "Total Arithmetic" score of the ITBS. The "Total Arithmetic" score, supplied independently by machine scoring and computation, is an arithmetic mean of the "concepts" plus "problems" sub-tests. As with the IPI Placement Tests, differences were computed by both ability group and grade level and are presented as percents in Tables 18 and 19.

Table 18

$\bar{X}$ Difference Scores: IPI/Non-IPI
School Comparison by Ability Levels Using ITBS

	Lo Ability	Av Ability	Hi Ability	Total School
School C*	-.19	.17	.38	.15
School D	.01	.62	.38	.40
School E*	.14	.58	.49	.39
School F				.28
School G*	.22	.02	.37	.18
School H	.32	.47	.50	.44

Mean significantly greater than the group being compared with.

*IPI Schools

Table 19

$\bar{X}$ Difference Scores: IPI/Non-IPI
School Comparison by Grades Using ITBS

	4th Grade	5th Grade	6th Grade	3rd Grade
School C*	.12	.04	.30	
School D	.67	.30	.28	
School E*				.39
School F				.28
School G*	.21	.05	.26	
School H	.25	.31	.79	

Mean significantly greater than the group being compared with.
*IPI Schools

Inspection of Tables 18 and 19 reveals an outcome highly similar to that seen with the IPI Placement Tests. With the exception of the 6th grade comparison at School C/School D, and the total School E/School F comparison (neither comparison being statistically significant) there is no significant difference in the achievement of the respective groups; all differences are insignificant or favor the non-IPI groups.

When considering both the IPI Placement Tests and the ITBS results together, it seems that one cannot avoid concluding that the acquisition of arithmetic skills (as measured by either or both of these instruments) is not enhanced by the use of IPI. To the contrary, our data suggest that such acquisition may even be hindered.

Before reporting on the reading achievement test results, we would like to mention a brief "side" study conducted during the school year. It was suggested that perhaps IPI was enabling students to learn to think more freely or independently and we were asked if we could possibly investigate this hypothesis. The result was a series of "problems" administered to sample groups (IPI/Non-IPI) of 4th, 5th, and 6th graders. The complete study appears as Appendix A of this report. Briefly, the outcome was in line with

the results reported above: IPI students did poorer or, at best, as well as non-IPI students. The details are found in Appendix A.

IPI Placement Tests: Reading

Originally the design called for treating the two reading schools in the same manner as the math schools. A number of factors, however, prevented the application of the pre-post IPI placement test design in both schools and we had to modify our analysis of the placement tests. The main factors were:

a) A number of the skill areas pre-tested were not post-tested because that skill did not appear at a sufficient number of levels (likewise some post-tested skill areas were not pre-tested);

b) scoring of reading placement tests is more subjective than in math tests; there was some question of interpretation since the IPI school scored its own tests while we scored the Comparison school tests;

c) we did not "test out" sufficiently during the pre-test phase and the IPI school did not "test out" sufficiently during the post-testing. Thus we were not sure whether level of mastery had been thoroughly determined.

As a compromise analysis we decided to select a discriminating level of mastery for each grade level and determine the percent of students who had and had not mastered that level for each skill area at the end of the school year. The weakness of this analysis, of course, is our inability to know whether the groups being compared started at similar mastery levels or not. An examination of the fall reading achievement scores, however, do provide a fairly acceptable estimate. Table 20 presents the percent of 4th graders in Schools A and B mastering each skill area. Achievement test (baseline) scores are also shown.

Table 20

Percent of 4th Graders Mastering Each Reading Skill Area at Level F

Skill	School A*	School B
Phonetic Analysis	50%	74%
Structural Analysis	59%	74%
Literal Comprehension	55%	74%
Interpretive Comprehension	64%	78%
Evaluative Comprehension	14%	13%
Organizational Skills	32%	22%
Reference Skills	23%	22%
	$\overline{X}$ Grade Placement	
Vocabulary	4.43	4.80[a]
Reading	4.53	4.23

*IPI school.

[a]Difference between Vocabulary and Reading means of the two schools are not statistically significant.

Allowing for the less than desired reliability of the reading placement tests, the data in Table 20 nevertheless suggests that, although the two samples are not markedly different in initial reading achievement, generally more of the Comparison School 4th graders have mastered Level F in most of the skills listed than IPI 4th graders. The results of the same analysis for 5th graders, using mastery of Level G, is shown in Table 21

Table 21

Percent of 5th Graders Mastering Each Reading Skill Area at Level G

Skill	School A*	School B
Phonetic Analysis	62%	35%
Structural Analysis	33%	55%
Literal Comprehension	21%	40%
Interpretive Comprehension	29%	55%
Evaluative Comprehension	29%	75%
Organizational Skills	46%	60%
Reference Skills	12%	40%
	$\overline{X}$ Grade Placement	
Vocabulary	6.34	7.00[a]
Reading	5.83	6.58

*IPI school

[a]Difference not statistically significant.

As can be seen in Table 21, the difference in percent of mastery of Level G are minimal; the slight advantage in favor of the Comparison School is readily explained by the higher vocabulary and reading achievement scores. It must be pointed out, however, that the IPI sample does not include those students who were not tested at Level G, eliminating in essence the slower students of the class since the IPI teachers there assigned placement test levels on the basis of "where they (the students) were just about finishing." Thus, those who were just about finishing Level E, for example, would not have mastered Level G, but were not included in the sample. If this latter group had been included the achievement score differences would probably have been too large in favor of School B to make reasonable comparisons. As the results in Table 21 now stand, there is no basis for favoring one instructional program over another as long as we are dealing with groups which are roughly comparable in starting level achievement.

Finally, IPI reading placement test performance for the 6th grade is presented in Table 22. Level G is again used as the criterion.

Table 22

Percent of 6th Graders Mastering Each Reading Skill Area at Level G

Skill	School A*	School B
Phonetic Analysis	52%	57%
Structural Analysis	57%	57%
Literal Comprehension	52%	70%
Interpretive Comprehension	83%	57%
Evaluative Skills	78%	97%
Organization Skills	87%	73%
Reference Skills	65%	57%
	$\overline{X}$ Grade Placement	
Vocabulary	7.83[a]	7.70
Reading	7.50	6.89

*IPI school

[a]Difference not statistically significant.

Even more than was observed with the 5th grades, the differences between the two 6th grade samples shown in Table 22 are virtually non-existent.

Before listing the possible interpretations of the IPI reading placement test findings, we should point out our reservations about the construction of these tests.

1) Scoring is still too subjective and arbitrary.

2) There are a number of instances where we believe a higher designated level within a skill area is easier than a lower level.

3) There are a number of sub-tests which are so narrow in their selection of items that a child is faced with a virtually dichotomous situation--he either gets 100% or 0%.

4) The failure for many of the skill areas to cover more than a very few levels limits the use of the reading placement tests as criteria of progress.

With these points in mind any of the following possible conclusions can be drawn from the data reported here.

1) Allowing for all the listed limitations, there still is no evidence that the IPI program enhances achievement on the IPI placement tests.

2) IPI reading classes compare more favorably with non-IPI classes as grade level increases; the greatest discrepancy is in the 4th grade with virtually none in the 6th grade.

3) There does not seem to be a clear or a correlated pattern of class achievement within each skill area over the grade levels.

4) Due to the relative crudity of the placement tests themselves, nothing can be said vis a vis relative achievement.

5) Following 4) above, at the present time it might be best to rely upon changes in standardized reading test scores as criteria for IPI/Non-IPI reading comparisons.

Iowa Test of Basic Skills: Reading

The ITBS was administered to a random sample of 4th, 5th, and 6th graders in the non-IPI school at the same time the IPI students were administered placement tests. The test was given in September and again the following May.

Two sub-tests are of interest here, the vocabulary section and the reading section. As with the math analysis, we compiled difference scores (the difference, expressed in grade levels (a ten-month year), between a student's pre and post-test score for reading and vocabulary respectively. The mean difference scores analyzed both on the basis of ability level and grade level appear in Table 23 for both the vocabulary and reading sub-tests.

Table 23

$\bar{X}$ Difference Scores: IPI/Non-IPI School Comparison by Grade and Ability Level Using the ITBS

	4th Grade		5th Grade		6th Grade		Total	School
	Voc	Read	Voc	Read	Voc	Read	Voc	Read
School A*	.70	.19	.34	.32	.25	.69	.42	.39
School B	.40	.60	.27	.06	.79	.72	.50	.48

	School A*		School B	
	Voc	Read	Voc	Read
Low Ability (all grades)	.36	.62	.37	.31
Av Ability (all grades)	.57	.33	.47	.64
Hi Ability (all grades)	.31	.23	.66	.48

*IPI school.
____Mean significantly different than the group being compared with.

Table 23 can be read as follows: Beginning with the first figure, .70, this means that in School A, the 4th graders gained, on the average, 7 months between the time of their first vocabulary test and the second.

The findings reported in Table 23 may be interpreted as follows:

1) Of the 14 IPI/Non-IPI comparisons made (7 for vocabulary, 7 for reading), 4 pairs reveal a statistically significant difference; three in favor of the

non-IPI group, and one (Lo ability reading score) in favor of an IPI group.

2) Reading and vocabulary achievement as measured by ITBS is not enhanced by IPI.

3) The expected spread in IPI achievement between ability groups is not observed; faster students do not appear to achieve more than slower students.

In general, the reading results, using the ITBS, corroberate the IPI placement test findings. Also, the effects of IPI on reading achievement are not dissimilar from its effects on math achievement; no evidence is shown of enhanced performance.

General Observations, Impressions, and Opinions

During the year we could not help forming certain opinions and receiving certain impressions which do not lend themselves to a formal analysis but which, nevertheless, may be of interest.

Teachers and IPI. Clearly, the teachers involved almost unanimously like IPI and believe it to meet the goal of individualization of instruction. They recognize the change in their role, the need for clerical aid, and the general enthusiasm of their students. We found, however, a fairly rigid, and at times, erroneous interpretation of what the IPI program actually is as envisioned by its developers. This is partly reflected in the student activity checklist described earlier, where IPI students are either working by themselves on a worksheet, waiting for assistance, or doing nothing. There is little, if any, flexibility on the part of teachers in breaking away from this pattern; teachers who conducted true group or seminar sessions were in the minority. Our impression, in general, was that teachers equated IPI with each child working on his worksheet. Most of the so-called "seminars" we saw were mainly traditional classroom settings and were actually out of the IPI context entirely. It would seem that teachers need to be encouraged to vary their methods more and that IPI is not synonymous with the individual worksheet.

A more serious concern on this topic, however, is the clear tendency for teachers to let the pre-established IPI continuum determine the prescription. We did some analysis of the prescription history of individual students and rarely found deviation from the prescribed pattern. We suspect there is a great deal of ambiguity on this issue both among the developers and disseminators of IPI. On the one hand, this following of the continuum seems to be encouraged while at the same time a teacher is (theoretically)

encouraged to deviate with individual students. If she is to follow the continuum fairly rigidly, then the computer and the clerk (or the student himself) can end up doing the prescribing and the teacher will do something else. The content of the prescription is basically determined by the child's achievement (starting from a hypothetical 0 point at Level A) and is rarely influenced by any individual characteristics of the child--his interests, styles, etc. The quantity of the prescription does usually reflect the teacher's impression of his learning rate and ability. It seems to us that teachers should be encouraged to deviate more frequently and freely from the prescribed IPI continuum in assigning work to students.

IPI: Structure and Content. Our data and our observations have clearly indicated the attractiveness of IPI to both students and teachers. But in our two years of contact with IPI we have become aware of the fact that it is the structure of the program--the individual assignments, the individual rates, the disappearance of "the lesson," the embedded testing, etc.--which has almost exclusively been the focus of attraction, with rarely a mention of the substantive or qualitative aspect of the program. Is the IPI material itself "good mathematics?" We are not qualified to directly answer this question but we do recognize that the content is the result of cut and paste from existing programs with no effort having been made to design or invent new material. There is little variety in the format of the worksheets and, more significantly, the kind of thinking required of the student. An examination of a random selection of worksheets will reveal a sameness and even "dullness" (when viewed in quantity) as to the kinds of problems students are required to work on. We believe that the material or content was included on the basis of its fulfilling the behavioral definition of the specific skill listed in the IPI continuum and on the basis of fitting into the

quasi-programed format of the entire program. Nowhere are there "think" problems, open-ended problems, or constructive problems. As we suggested in an earlier section, it may well be that IPI-trained students may be deficient in these skills. We do not believe that school teachers and administrators in the local districts involved with IPI have seriously examined the content (again, as opposed to the structure or form) to see if this is what they would prefer for their students and that their enthusiasm is almost exclusively based on the idea of individualization.

Pedagogically, it is difficult to discover a rationale for the set IPI sequence. Why all children should proceed (albeit at thier own rate) from numeration to place value...to multiplication to...combination of processes, etc. and then repeat the cycle is never made clear nor does what is known about the development of mathematical concepts provide an answer. We further question, pedagogically, whether there is sufficient manipulatory activity at the primary levels; the tendency for young children to confuse numbers and numerals in such a paper and pencil and word-oriented program might be a larger problem than is suspected.

Motivation and IPI. We have alluded repeatedly throughout this report to the clear evidence of student interest in IPI. Following the discussion directly above, we need to analyze the meaning of significance of this. Psychologically, we generally speak of motivation in learning as being intrinsic or extrinsic. Depending on one's theoretical position (centralist, developmental as peripheralist, environmental) intrinsic motivation is either the result of initial extrinsic incentives or extrinsic incentives are needed when the initial intrinsic motive weakens. At any rate, all agree that it is preferable that a task be learned "for its own sake"--because it is "interesting," because the child wants to--over a task which is learned

mainly because someone else wills it or because there is some external reward (recognition, awards, etc.) to be gained. What is the situation with IPI? We suggest that much of what is seen as high student interest is a result more of extrinsic motives: achievement seen in terms of one's own standards and also in competition with others; the sense of satisfaction coming from relatively frequent completion of short-term, successful tasks; the awareness of "progress" along a continuum indicative of "success." These motives are not to be belittled in any way, but they are not necessarily related to the substantive or content nature of the task at all. In other words, one could see as high a level of motivation even if the content were essentially meaningless; rarely did we get the feeling that the students were finding mathematics per se intrinsically more meaningful or interesting. On the other hand, it is clear that for many children the mere fact that the act of dealing with math is rewarding in any respect is worthy and encouraging. Thus, we conclude as we concluded above; when the attention given to the form and structure of IPI is turned to the content, the program will be materially improved, not only in motivational terms, but, most probably, in performance or achievement terms as well.

IPI and Individualization. Part of IPI's appeal, not only to those involved in it but to the informed public as well, is its clear break from the lock-step prototype of the conventional classroom. Put in other terms, it represents a shift away from the completely teacher-directed and teacher-controlled instruction to greater student control. At first glance it would be a sacrilege to even question this shift; nevertheless, some cautionary comments are in order.

The IPI we saw in operation may not have matched the model envisioned by the developers, but we suspect that with increasing dissemination, the distance

in time and influence between the developers and the users will result in practices more nearly like those we observed rather than those envisioned. As such, we would describe the typical IPI classroom pattern as one in which the student works mostly on his own; works under a scheduled, structured pattern of assignments (prescriptions) and depends on the teacher (aide, test score) for direction (next prescription). True, he can proceed at his own rate and at his own performance which in turn determines the next assignment. But to the degree that the class or school adopts this particular pattern (as a replacement for the teacher-centered pattern) it is no more individualized in terms of the learner's style than was its predecessor. In other words, it has been shown that any single instructional pattern does not and will not meet the individualized personality or learning styles of a classroom of children. For example, we know that certain children will learn more and feel less anxious in a structured, teacher-directed setting; others in the unstructured (independent study) setting, still others in group-oriented settings. IPI, as we saw it practiced, does not provide individualized instruction in this sense of the term. It is fairly certain that some proportion of children would achieve more in a setting other than that of the individual worksheet. The IPI concept, in theory, is able to possibly accomodate different learning styles. Whether it can, in practice, remains to be shown.

Finally, however, one comes back to the finding, for the second year now, that measured achievement in IPI is less than that observed in non-IPI classes. If this finding is found in other areas where IPI is being tried out, it would seem that further development might be in order before the program is disseminated nationwide.

APPENDIX A

Introduction. Although virtually every elementary math curriculum purports to provide students with the "basic" skills, some diverge after this point to emphasize different student behaviors. For example, the Math Workshop series includes among its objectives the hope that students will be "challenged to think about relationships, look for patterns and clues and to draw logical conclusions for themselves." A comparable statement cannot be found in a description of IPI because such a statement is too imprecise and not stated in measurable, observable terms. Yet, it is unlikely that the designers of IPI would contest the statement as it appears above. That is, every math curriculum designer would like to see students "challenged to think, etc...." In fact, an elementary math curriculum which purported to provide only "basic skills" and did not claim to help students "think" would probably be most unacceptable.

It has been suggested, that in addition to providing variability in class achievement and rate, IPI might also foster "independence." Unfortunately, there are at least two distinct uses of this word in the context of IPI; in one case it refers to the procedural behavior of a child in the classroom--getting his own worksheets, assuming responsibility for completion of his work, grading his own CET's, even writing his own prescriptions. In the other case, independence can refer to the liberating effect of the curriculum on cognitive operations and conceptual thinking. To the extent that the advocates of IPI would support the latter use of the term, to that extent would the Math Workshop objective stated above be accepted. It is on this basis that we were urged to explore the effect of IPI on "independence" of thought, the hypothesis being that such behavior should be more frequent in IPI classes in contrast to the Comparison school math classes.

In order to attempt to measure this we adopted directly, or in modified form, four "word problems" or number games from the Math Workshop Teacher's Guide.[1] The rationale and description of the problems will be described below, but our basic criterion for selection was the notion of challenge--questions which would encourage investigation and thought beyond the application of a single acquired operation. We will also present the results, along with the description, to facilitate comprehension of this report. This section follows immediately after the design and sample section below.

Design and Sample

In addition to two IPI schools and two Comparison schools, we were able to locate a school district which had been using the Math Workshop curriculum for two years. They indicated a willingness to serve as an anchor point for this brief study. We assumed that students exposed to this curriculum would, by virtue of familiarity and orientation, achieve higher scores than those in a conventional math curriculum (both Comparison schools use the Silver-Burdett Series[2], a state approved text). We were, therefore, not concerned with using their results as the standard or criterion score for the IPI and Comparison schools. Rather, we conceptually envisioned their results as the ceiling, the Comparison (conventional math) as the floor, and the inquiry as to whether IPI classes would be closer to the ceiling or to the floor.[3] We repeat--we do not expect IPI or any other students to compare favorably with

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[1] Wirtz, Botel, Beberman, & Sawyer. Math Workshop, Encyclopedia Britannica Press, Inc., Chicago, Illinois, 1965.

[2] Silver-Burdett Series. Modern Arithmetic Through Discovery.

[3] Technically, that means that in tests for statistical significance we would expect the Math Workshop group to be significantly higher than both IPI and Comparison schools. But for the current hypotheses to be tenable, IPI must be statistically significantly higher than the Comparison groups too.

a group who has been exposed to types of items which have been an integral part of their curriculum but achievement of this group does provide a point of departure or a standard of comparison.[4]

All students were administered the items within a one month period during the spring semester. Students are a random sample of heterogenously grouped fourth, fifth, and sixth[5] graders in the respective schools. The sample design appears in Table 1.

Table 1

Curriculum		Grade 4	5	6	TOTAL
Math Workshop	N =	26	28	30	84
IPI-A	N =	30	30	--	60
Conventional A	N =	27	30	--	57
IPI-B	N =	--	25	30	55
Conventional B	N =	--	32	27	59
	TOTAL N =	83	145	87	315

The test items were reproduced and administered to a classroom at a time. The items were introduced with the following statement:

> "Here are a few number games. They may be quite different from the kind you are used to because there is not just one possible answer. Try them all. If you need more space use the back of the page."

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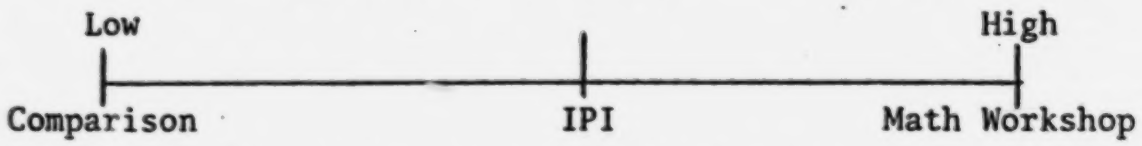
[4] In this instance we are stating a directional hypothesis; we are saying more than that the three groups have been randomly drawn from the same population. We are stating a stronger hypothesis, to wit: Math Workshop students will do significantly better than conventional students as will IPI students. We do not expect IPI to do as well as the Math Workshop group--there should be less differences, however, between IPI and Math Workshop students than between IPI and Comparison students. The paradigm for the hypothesis being tested looks like this:



Accordingly, our statistical analysis involves one-tailed tests.

[5] The fifth and sixth graders were in their second year of IPI, the fourth graders in their first year.

The only constraint was that students were not allowed to ask for clarification or further instructions. We arbitrarily allowed a total of 30 minutes. We did not observe any students who had not completed their efforts in that time.

Rationale and Description of Problems and Results

The first problem was to operationally define the behavior we were interested in measuring. One aspect might be called divergent thought or handling unstructured numerical situations. In behavioral terms, how many different but relevant relationships could students generate given a set of numbers? Accordingly, the following item was presented:

"The other day six children were asked to each write down his 'favorite' number. Here are the six numbers they picked:

15 4 30 1 44 9

How many different things could you say about these six numbers? For example, you could say that three of them are odd numbers and three are even, or you could say that the difference between the largest number (44) and the smallest (1) is 43. How many more things can you think of to say about these six numbers? Write down as many as you can think of."

As can be seen, there is almost infinite number of possible answers. We were interested in simply seeing how many different relevant things students could say and were not concerned with their computational accuracy. Clearly, there is no preferred or right answer(s) but there are qualitatively "better" answers. For example, a response, "the sum of the six numbers is a prime number" is "better" than a response, "15 goes into 30 two times." However, in order to avoid undue controversy, we decided to simply count the total number of relevant responses generated by a student. In order for credit to be given, at least two of the numbers in the set had to be related in some or any operation the student might think of, even if the outcome of the operation were

incorrect. The results, graphically presented here, are in terms of mean number of responses for each identified group of students. Figure 1 presents these results for all groups sampled. A space between any bar represents statistical significance;[6] the absence indicates that although one mean may be higher than another, the two means do not differ significantly. Differences are determined by "t" tests.

The findings can be summarized as:

1) In all four IPI-Conventional school comparisons, the IPI group has a lower mean; in three of the four instances, a statistically significantly lower mean.

2) The Conventional groups in grades 4 and 6 compare favorable with the Math Workshop groups (or to express it differently, the Math Workshop groups do not do better than the Conventional groups) suggesting that IPI possibly depresses or inhibits this kind of behavior.

3) Conclusion: The hypothesis that IPI enhances this kind of thinking is not supported.

A second aspect of independence could be the freedom or ability to discern patterns within a set of numbers. In this particular instance, we presented a sequential series of numbers thusly.

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[6].05 level of significance is used throughout the study.

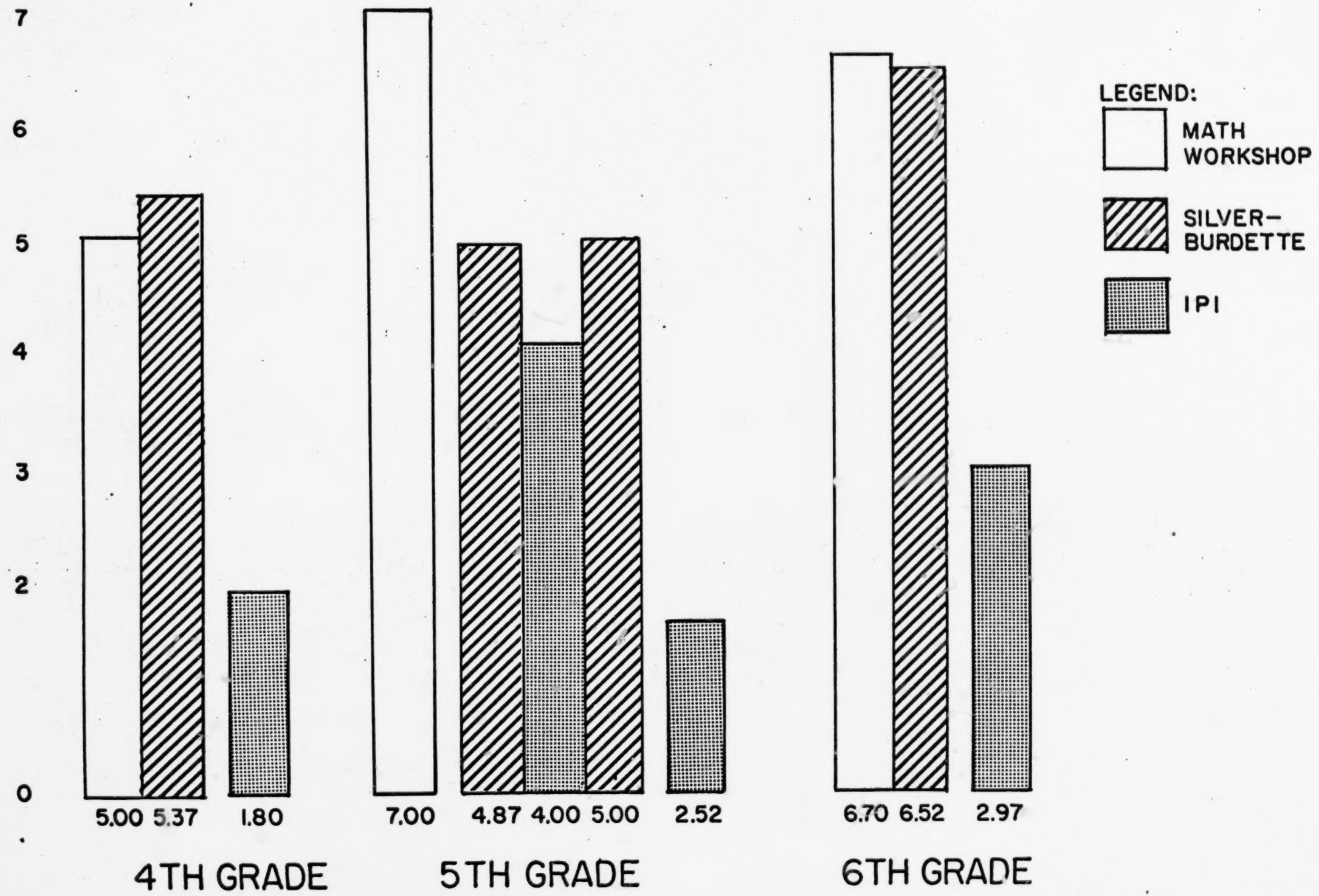

FIGURE 1: MEAN (X) NUMBER OF RESPONSES TO A NUMBER PROBLEM

"A teacher was playing a number game with her class. She told them that she has a secret rule and that every time a student called out a number she would answer with another number. If they listened to the numbers she gave they would be able to figure out her rule. The first child called out 5 and the teacher answered 9. The next child called out 8 and she answered 15. Soon it looked like this:

Student called number	Teacher answered
5	9
8	15
4	7
12	23
2	3
19	37
6	11
11	21
7	?_____ fill in
10	?_____ fill in
1	?_____ fill in

Can you write down the teacher's secret rule?_____"

This type of problem is, of course, a form of hypothetical-deductive thought; given a number of instances, can the student deduce some general rule which will allow him to predict subsequent events. Whether this item is solely a function of mathematical training or not is moot: clearly, however, students are being asked to discern a pattern among numbers. The item was scored right on the basis either of a statement presenting a general rule which was appropriate (there are at least three different forms of stating the rule) and/or filling in of the correct numbers in the spaces provided. The results, presented in graphic form in Figure 2, are expressed as percentage of students scored correct. Statistical differences for this one item were determined by X^2.

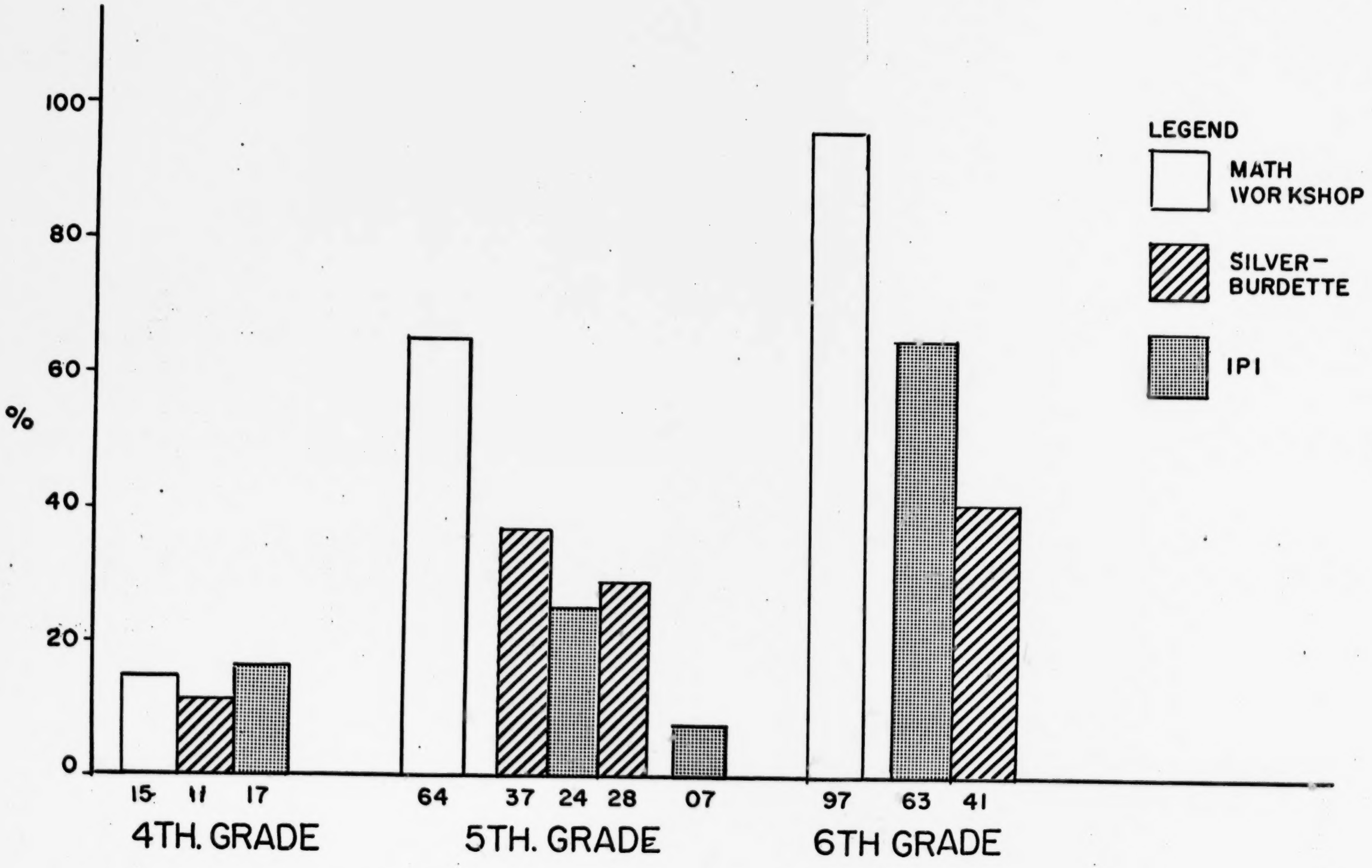

FIG. 2: PERCENT OF STUDENTS SOLVING NUMBER-SEQUENCE PROBLEM

Summarizing the results we find the following:

1) The problem does not discriminate among schools at the 4th grade level. An insufficient number of 4th graders in all schools were able to figure out a solution.

2) The Math Workshop - Conventional school differences at the 5th and 6th grade levels are statistically significant; there is a ceiling-floor effect.

3) The IPI groups do not do significantly better than their comparison schools; in one case they do significantly poorer, in another case they do better, but not significantly so.

4) Conclusion: IPI does not enhance this kind of behavior.

Another facet of "independent" thought is the ability to break away from the obvious, or to put it differently, to invent relationships which are not readily suggested by the presentation of the problem. Far too often children are exposed to problems with one "answer" and the question remains whether such exposure inhibits the ability to see more than the obvious. For example, here is another problem we presented to our sample:

"Let's try another 'think' problem. Here are three paper cups:

Helen had 4 pieces of chalk. She put them in the cups. How many things can you say? Think about it and write down as many things as you can about the cups and chalk."

The obvious relationship is, one piece in each cup with one remaining, or 1 1/3 pieces in each cup. We were interested in discovering whether the different curricula would influence the number of relevant statements children

could provide in addition to the obvious one. We gave credit for any statement involving the number of cups or pieces of chalk and any combination derived from these two starting quantities. Again, if the hypothesis concerning the liberating effects of IPI is correct, we should expect that the IPI group would provide significantly more acceptable responses than the Comparison school using a conventional curriculum. Results are shown in Figure 3 by grade level and curriculum.

Examination of Figure 3 reveals:

1) Overall, there is not a large number of acceptable responses (means range from almost 4 to less than 1).

2) Math Workshop groups are significantly better at all grade levels.

3) IPI groups are significantly lower than Conventional groups in two of the four comparisons made (4th grade and IPI-A, 5th grade).

4) In no instances do IPI groups perform better than Conventional groups.

5) Conclusion: IPI does not enhance, and perhaps hinders somewhat, the kind of mathematical behavior required for this task.

Finally, we included an item which might be considered as being intermediate between a totally open-ended task and a single-solution task. Here is the problem as presented to the children:

"Here is a list of some school supplies and their cost:

Paper	8¢
Crayons	15¢
Paints	18¢
Notebook	25¢
Pencil Box	27¢

Helen bought 2 things from the school supplies listed above. They were all different. What can you say? For example, if she bought crayons and a notebook, then she spent 40¢. What else can you say?

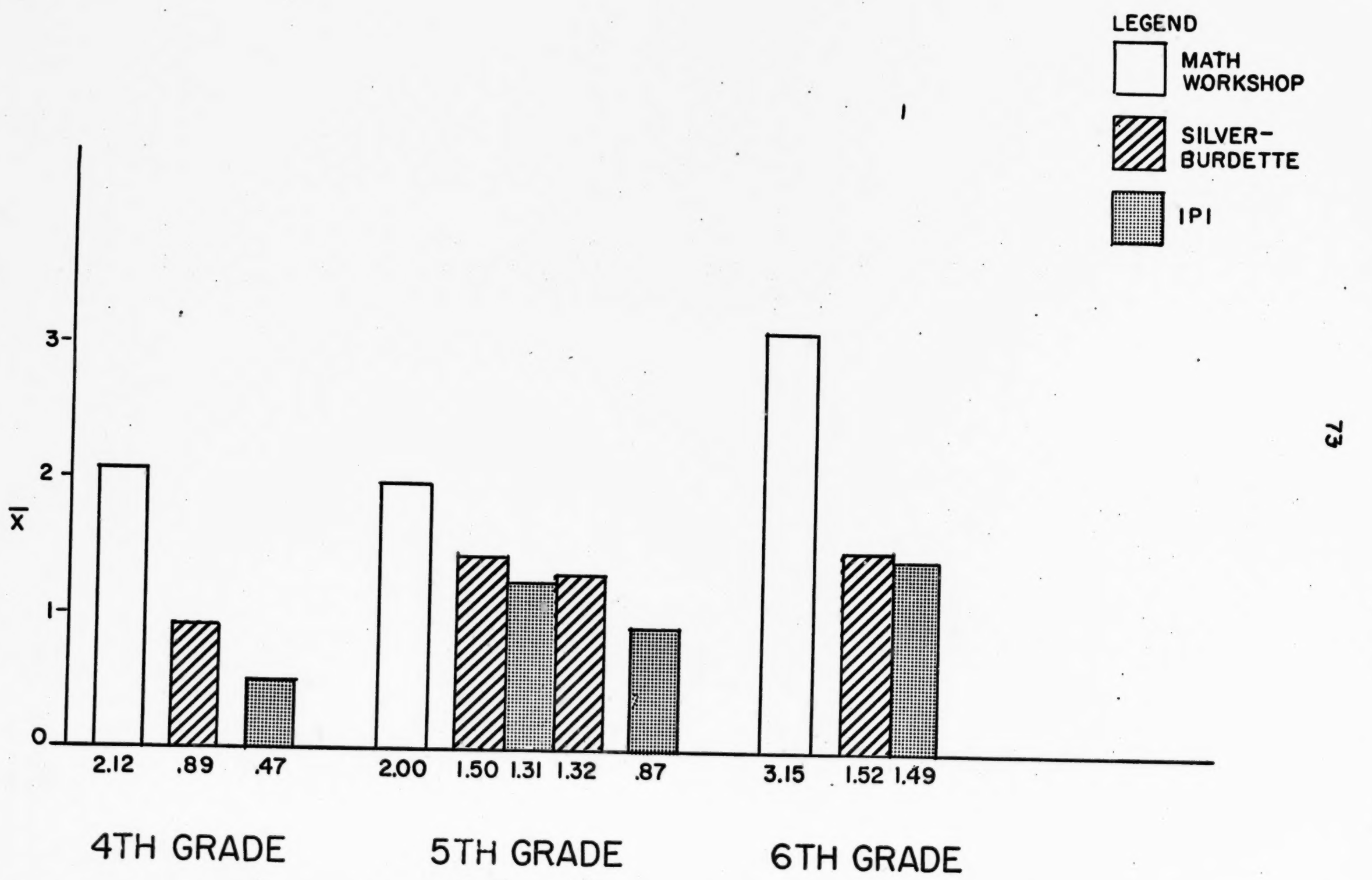

FIG. 3: MEAN ($\bar{X}$) NUMBER OF RESPONSES TO CUP AND CHALK PROBLEM

As stated, there are essentially 12 responses--the 10 combinations (5 things taken 2 at a time) and the limits (the least and most one could spend). Will students perceive the pattern of combinations and thereby generate the maximum number, or will they respond on a one-by-one basis? Of course, a student could generate many other relational statements from the information given, but this proved to be most rare. Invariably, students responded in terms of Helen's task. The results are shown in Figure 4.

It can be seen that:

1) The 4th and 6th grade Math Workshop-Conventional school differences provide, again, a ceiling-floor effect.

2) For the 5th grade, both Conventional groups and one of the IPI groups compares favorably with the Math Workshop group.

3) In no instance does an IPI group numerically or statistically exceed a Conventional group.

4) Conclusion: IPI does not enhance this kind of thinking in 4th, 5th, and 6th graders.

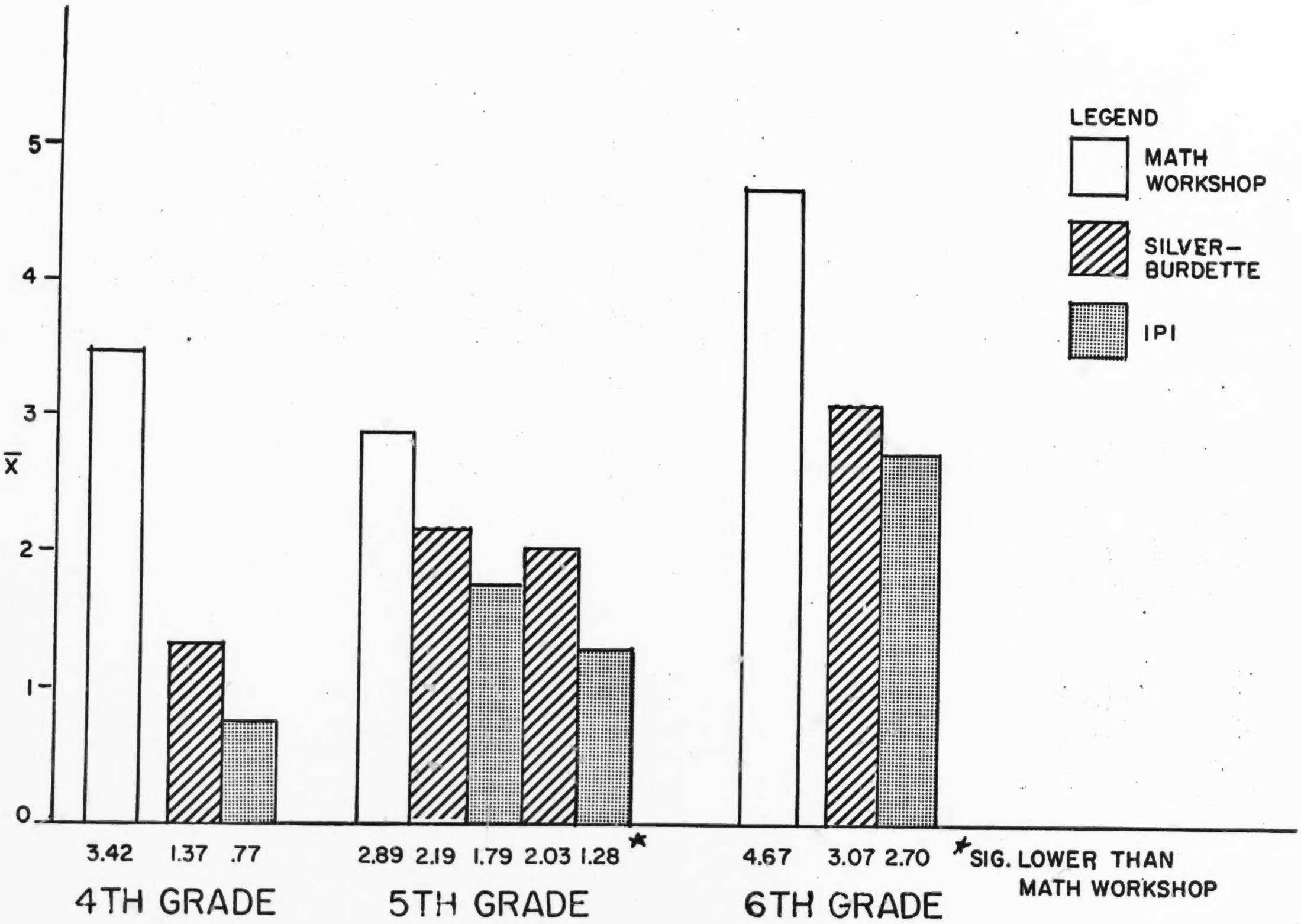

FIG. 4: MEAN ($\bar{X}$) NUMBER OF RESPONSES TO SCHOOL SUPPLIES PROBLEM

General Comments and Conclusion

This short study cannot be conceived as definitive in any sense of the word. It would be entirely legitimate to argue over the rationale for the particular items chosen, and more importantly, whether they are tapping independent or partially independent thought processes. In fact, we considered combining the responses to all four items, but chose not to because we thought it would look suspicious and because there is certainly some justification for examining these separately, at least during such a preliminary investigation. If we had combined the four items, the differences between method would have been even more conspicuous as one can see from inspecting the data presented here.

Be that as it may, the results warrant serious consideration because of the consistent and discouraging (for IPI, that is) trends we have observed. As we have mentioned repeatedly, we do not expect other groups to evidence the overall capability of the Math Workshop group in the particular behaviors under examination; but we do not know how to rationalize the lower IPI performance vis a vis the Conventional schools. These latter schools, to our knowledge, utilize available math materials in the traditional classroom setting. Even if one argues that, after all, IPI is not focusing on these behaviors, it still behooves those responsible to explain why such behaviors seem, in the main, to be hindered in the IPI setting. To reject such behaviors as undesirable or as not necessary does not seem warranted. In fact, the items were initially inspected and approved by an IPI proponent as having the potential for eliciting the desired behaviors. We would recommend a more extensive and intensive investigation of the phenomena observed in this brief study since it is clear from the national publicity, the wide dissemination,

and a perhaps somewhat uncritical acceptance by school people, that IPI will become a prominent feature in American education. Its many positive qualities must not obscure possible faults, especially during these early developmental phases.